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ELECTRICAL SWINDLES.

One of the most astonishing things in the world is the gullibility of people who ought to know better. Periodically the newspapers are filled with accounts of the sharp practices of swindling concerns, but despite the warnings contained in so many exposures the public continues to furnish victims and the confidence men keep on fattening upon them. Most unfortunately the electrical field has been chosen of late as the favorite theatre of operations for a class of swindlers whose victims are too frequently the last people who would be supposed to lend ear to their tales. This has been notably illustrated by the class of persons defrauded by the "electric sugar refining" steal, of unsavory memory, and those who are to-day finding themselves victims of the latest ingenious confidence game —the electrolytic extraction of gold from sea-water.

The history of this scheme is somewhat interesting. It has been for a long time a matter of common knowledge that sea-water contains gold, in the proportion of about one-half grain to the ton. This fact has been regarded as a curiosity of statistics, since it is obvious that no process for the extraction of the gold could possibly pay for the handling of the vast masses of water in which it is dissolved, until a clever swindler conceived the idea of combining this piece of information with the general faith in the ability of electricity to do anything difficult and uncommon, and to float the shares of a corporation for the extraction of the gold from the bulk of raw material in easy reach. It is needless to say that the company was capitalized for an enormous sum, that the shares were of small face value so as to attract small investors, and that the "process" was secret. A factory was erected at a small town on the coast of Maine, "so that the fall of the tide might be utilized," and operations commenced. Weekly a "gold brick" was sent to the offices of the concern in Boston, and subscriptions to the stock increased apace until the sudden flitting of the chief promoter and head charlatan with the available funds of the concern one day last week.

There are just two points about this sort of thing that merit close attention. The first is that the people who lose by such swindlers have no one but themselves to blame. The trouble with most people is a prodigal sense of self-sufficiency. While very few people would embark upon litigation without a lawyer, or fail to send for the doctor if they fell sick, nearly every average man is willing to go into a speculation in some "electrical" scheme without the advice of a competent engineer. The small fee required for the examination of the prospectus of this last swindle by an engineer—for his examination would have extended no further—would have saved many investors their fortunes and many perfectly innocent and honest people, who were beguiled into appearing in various responsible capacities in connection with the electric sea-water business, their reputations. The most evident moral of the totally immoral proceedings of the sea-water-gold concern is that it pays to consult an engineer before embarking upon an electrical business.

The second point is that the continual appearance and exposure of electrical frauds is detrimental to every honest and respectable electrical enterprise. The majority of these fraudulent schemes are self-evidently such, as, for example, the power-multiplying device recently exploited and actually exhibited. Against such it seems

that not only the technical press, but those engaged in any branch of the industry, should wage unceasing war. They should be exposed before the harm is done, not afterward. There is no public service that can be rendered by the members of the electrical fraternity greater than the stamping out of the charlatans who bring it into disrepute and the swindlers who use the legitimate triumphs of science to mislead and rob the public. The public cannot protect itself from these thieves, because it does not know how; those of us who do know how can protect not only the public, but ourselves as well, by combining for the exposure and prosecution of all sorts of electrical fakirs. There are some shining marks for preliminary target practice.

SWITCH CONTACTS.

With the small powers used in earlier electrical work, almost any sort of a contact in the circuits would serve and its disadvantages would not be recognized by the crude means of measurement then available, but with the enormous machines of the present day, even at comparatively high voltages, it is found to be a difficult matter to get contacts which are frequently opened and closed to carry their heavy loads satisfactorily. As with many other types of electrical apparatus, the heat radiating surface of switches does not increase in proportion with the amount of material in the instrument, while, on the other hand, the heating effect tends to increase as the square of the current used. The maintenance of a good firm contact over the whole surface of switch blades, clips and hinges becomes more difficult as the size increases, owing to the greater stiffness and inelastic rigidity of the parts.

The experiments of one prominent construction house in this particular field have shown a most surprising opportunity for improvement over the standard form of switch blade and clip of American practice. The simple substitution for flat clips and hinges of dished washers split radially at several points with their concave side pressing against the switch blade has reduced the heating effect and consequently increased the capacity of switches of given weight surprisingly, and this improvement is apparently not a very near approach to an ideal construction. The ordinary switch blade, after being opened a few times under load, becomes burned, the resulting burr holding the clips away from the blade by a very small distance perhaps, but sufficient to reduce the conductivity greatly. The independent sectors of a washer split as described can each bear upon the blade of the switch independently, and but one of them is likely to be seriously burned. An ideal construction would be, if it were possible, one similar to a contact universally used in one prominent type of circuit breaker, namely, from a solid copper plate to the tips of a large number of thin, hard rolled copper leaves, each one of which is brought to bear by its own natural spring. Switches approximating such a construction are quite widely found on English switchboards, although practically unknown in this country.

THE GROWTH OF THE ACETYLENE INDUSTRY.

In spite of the hue and cry raised by its opponents as to its danger—a case in which "history repeats itself"—the new illuminant, acetylene, is developing a field for itself with surprising rapidity. The oft-repeated suggestion made at the time of its début, that its production would give a paying day load to central stations, is apparently of no practical application, the extremely high cost of central station power, even under this favorable condition as compared with power generated in large quantities at water falls, necessitating the location of carbide works at the latter points. The plant built by the Acetylene Heat, Light & Power Company, at Niagara Falls, was not considered a small one at the time of its construction, but the new one of the Union Carbide Company at Sault Ste. Marie, a description of which may be found on another page, will have a capacity ten times that of the former, with a canal capacity sufficient to quadruple this output.

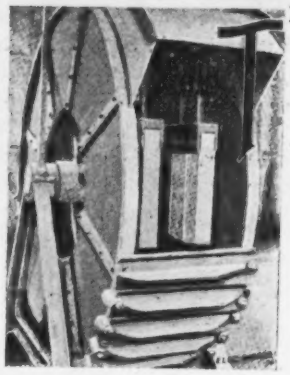
As with most new industries, and noticeably with the production of new illuminants, the processes are found quite dangerous at first until experimental work has developed means for avoiding the dangers. The National Board of Fire Underwriters has approved a new set of rules relative to acetylene gas, the most strict of which appears to be one requiring the location of the generating and gas-holding apparatus, when installed for the lighting of buildings in districts closely built up, in separate fire-proof buildings. No distance between these and other buildings is required, and conformity with the few simple rules eliminates all extra risk and consequent increase of insurance rate. The ability to use a local generator for each installation was advocated as a great advantage at first, but from present appearances will not find any general application, except in the cases of isolated premises separated long distances from their neighbors. It appears that acetylene is more likely to be centrally generated and distributed, just as ordinary illuminating gas is at present. In fact, one town in Connecticut has already commenced the distribution of acetylene in its existing gas mains, and others are about to take the same step. Small generators are, however, applicable, as shown by the extreme case of bicycle lamps, which are already highly successful and widely used, some 60,000 being already in service.

As a competitor in the illuminating field acetylene will probably be a greater rival of illuminating gas than of electric current, and it is possible that its success will be of more benefit than harm to the latter. It is the old story over again of one rival stimulating another in competition, and by means of improved service and reduced cost increasing the demand by an amount greater than its own supply. Illuminating gas, electric lighting and acetylene all have their own individual advantages which to a certain extent outline certain fields of application of each in which the others cannot compete. For vehicle lighting, including train lighting, and for gas distribution where but a small percentage is used for fuel, acetylene will probably show advantages over other forms of gas; while for combined heating and lighting service frone one system, illuminating gas cannot be met by either acetylene or electric current, but for isolated plant service, theatre lighting and all cases where ease of control from a distance, or convenience of ignition, or adaptability to special decorative effects, are of any importance, the electric current has the advantage. It cannot be met by its competitors in the qualities of safety, neatness, cleanliness, convenience and elegance.

An odd reversal of conditions in the central station field is likely to be caused by the competition of this new illuminant. Heretofore the distribution of power has been taken up as an accessory to the distribution of light from the same installation and preferably of late from the same machines and lines. The convenience of this combination may soon be recognized as a strong advantage of the electric light over the acetylene light.

The acetylene flame, like that of the Welsbach incandescent gas burner, has a high intrinsic brilliancy and its general use will bring into contempt the red gas flame and incandescent electric light of low efficiency and consequently of low brilliancy. The public will demand all the more a white hot filament, and central stations should look closely to their reputation in this regard. Those stations running with poor regulation and poor lamps looking often like red-hot hair pins will suffer most from this new competition. By greater care in construction on the part of the lamp manufacturers and in regulation on the part of central station engineers, combined with a wise use of the so-called "baby" enclosed arcs where they show advantages over the incandescent filament, this new competitor can probably be made to do the electrical industries more good than harm.

The New Plant of the Union Carbide Company at Sault Ste. Marie, Mich.



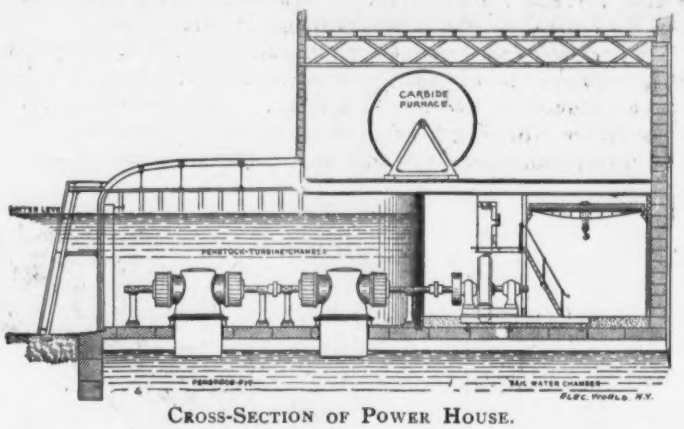
THE demand for acetylene gas and hence for its essential material, carbide of calcium, has increased during the last year at such a surprising rate that the Union Carbide Company has started the construction of a new plant, of which the part now under way will have a capacity many times that of all existing plants in the United States. Before taking up a description of this new equipment it may be well to describe the relationship of the different companies promoting the acetylene industry in this country, these companies having been reorganized a few months ago.

The Electro Gas Company, with offices at 45 Broadway, New York City, is the parent company, owning the fundamental patents of Bradley as well as those of Willson, but this company does not itself engage in the industry, licensing the sub-companies mentioned below. The officers of the Electro Gas Company are Charles F. Dieterich, president; A. B. Proal, secretary and treasurer; and E. Stein, general manager.

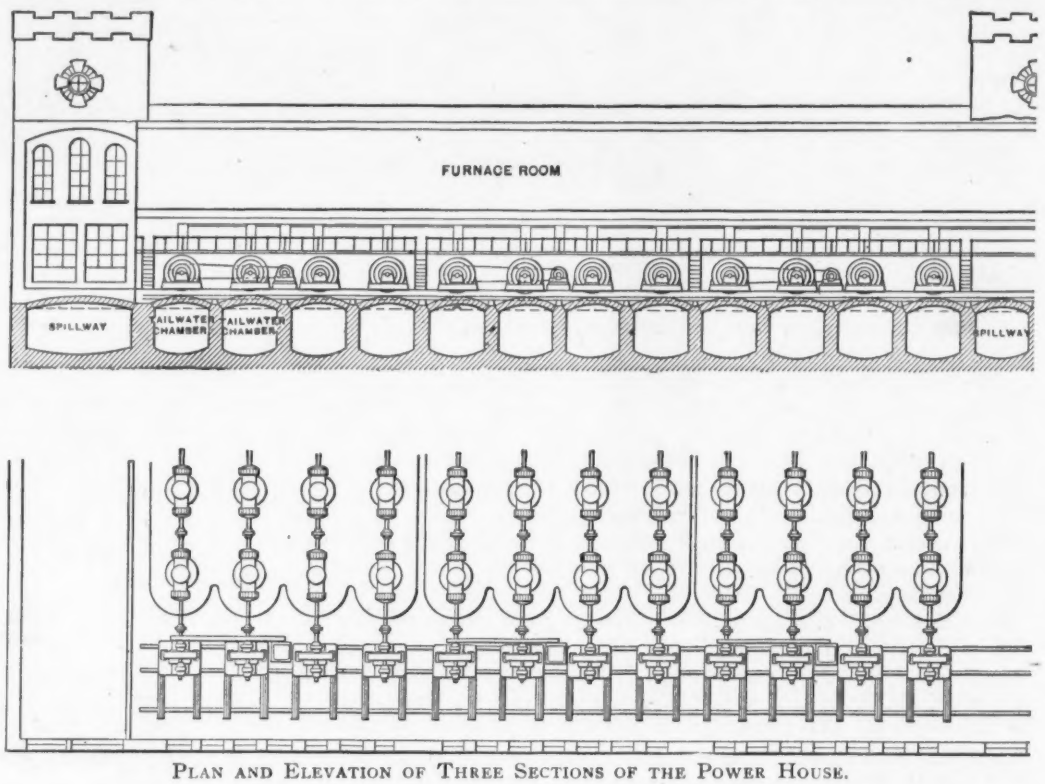
The Union Carbide Company, New York and Chicago, controls exclusively the manufacture of calcium carbide in this country, having purchased the licenses and works of the Acetylene Light, Heat and Power Company (these being the famous works at Niagara), those of the Lake Superior Carbide Company at Sault Ste. Marie, Mich., and also those of the Illinois Acetylene Company at Appleton, Wis. The president and secretary and treasurer of the Electro Gas Company mentioned above also occupy the same positions with the Union Carbide Company, Mr. Stein being the manager of the Eastern and Export Sales Department of the latter. Beside these two companies there is the Electro Lamp Company, which manufactures portable acetylene lamps and controls the sale of carbide for such lamps.

The manufacture of the carbide has heretofore been largely carried on at Niagara Falls, the plant there being capable of an output of 10 tons of carbide each twenty-four hours. This output is not nearly sufficient to supply the growing demand, and the Union Carbide Company, finding itself many months behind its orders, has contracted for a plant at Sault Ste. Marie, whose initial output will be ten times that of the Niagara plant and which will be capable of an extension to several times that size, as the demand for carbide becomes greater. The present plant at the "Soo," which was described in these columns,* consists of a small plant equipped with five of the carbide furnaces designed by Mr. W. S. Horry. This plant is on the American side and is supplied with power from turbines driving Horry generators in the pulp mill of the Lake Superior Power Company on the Canadian side. The new plant, the hydraulic part of which is being built for the Carbide Company by the Lake Superior Power Company, under the supervision of Mr. F. H. Clergue, will be located entirely on the American side, the furnaces being immediately over and within a few feet of the generators, so that there is no necessity of any transformation to and from high voltage for transmission purposes.

The plant will be situated on the shore of the St. Mary's River, through which Lake Superior empties into Lake Huron, and about 3000 feet below the foot of the rapids over which the enormous discharge of water tumbles with a fall of 19½ feet. The power canal is about 11,000 feet long, taking its water about 1000 feet above the rapids and above the opening of the American ship canal immediately beside the rapids, through which the enormous tonnage passing from one lake to the other is locked. The canal is designed for an ultimate development of 40,000 horse-power, with an effective head of 16.2 feet at the power house. The built-up nature of the adjoining property making the use of a very wide canal out of the question, a canal velocity at full load of 7.5 feet is being planned for. This requires a cross section of 4200 square feet. For 2800 feet the canal is in rock with a rectangular prism 200 x 22 feet, the sides being channeled. The rest of the canal is in sand, gravel and clay, with a trapezoidal prism 22 feet in depth, 175 feet wide at the bed and about 220 feet at the surface, with bed and slopes protected by a timber revetment, the whole closely floored with planking. Above the water surface the slopes will be stone paved. The canal will be widened out at its lower end to a forebay 1400 feet in width, its long side shut off from the river in front of it by the long power house described below. The depth of the forebay back from the power house will be from 150 to 300 feet. The sloping banks will be timber revetted, as will those of the canal.



CROSS-SECTION OF POWER HOUSE.



PLAN AND ELEVATION OF THREE SECTIONS OF THE POWER HOUSE.

The portion of the power house now in course of construction will be capable of containing forty generators and sixty electric carbide furnaces, eighty turbine wheels and the necessary supplementary electrical machinery, switchboard facilities, etc. The building will consist of two stories above the tail water chamber. The lower story, which is below the upper water level, contains the penstock turbine chambers, the generators, exciters and switchboard gallery. The upper story is devoted entirely to the carbide furnaces.

*See THE ELECTRICAL WORLD, June 25, 1898, pp. 776 and 784.

The turbines are arranged in groups of four sets in each chamber. Each of these sets consists of two pairs of wheels, with central discharge direct coupled to a generator by a horizontal shaft passing through the bulkhead. The arrangement may be easily seen from the drawings accompanying this description.

The generators are arranged in groups of four, each group having a 100-hp direct-current generator as exciter, driven by a belt from a pulley on one of the main shafts. Above the generators is the switchboard gallery, each generator having immediately over it its own panel, which is fitted with a voltmeter, ammeter and integrating wattmeter, so that the total electrical output of each machine may be read at any time.

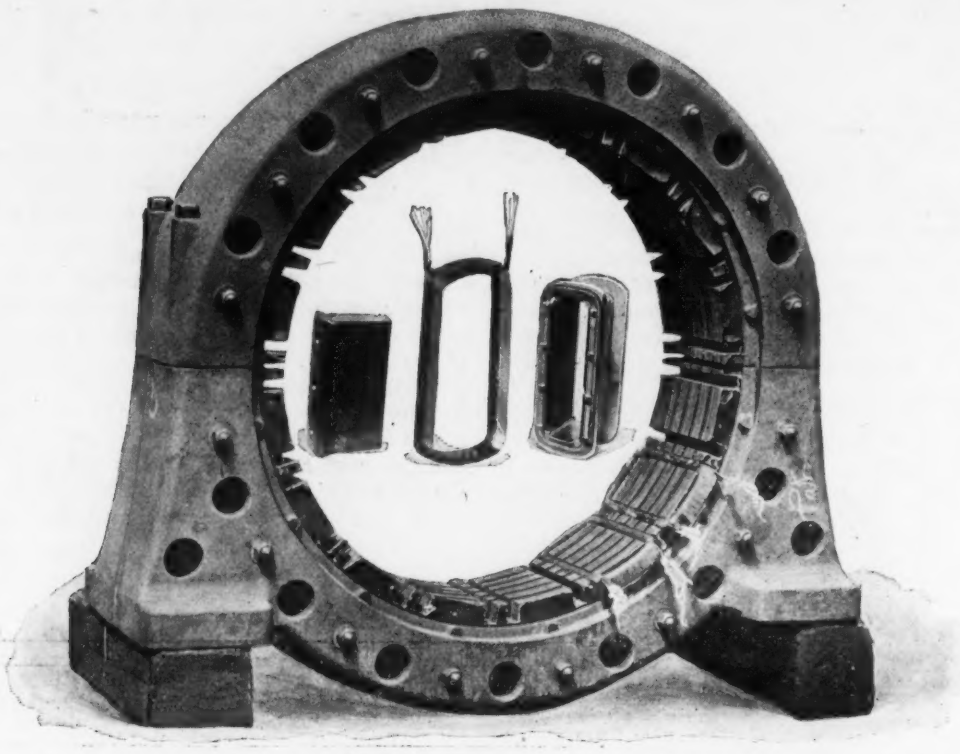
The leads from each generator are carried directly up to the corresponding switchboard panel, and the panels are connected together by massive bus bars of 2½ inches by 2 inches copper, in order to carry the enormous current which is used in the furnaces. In practical operation the generators will be connected up in sets of four in multiple, and the combined output of these four machines is sent directly from the bus bars at the back of the switchboard up into the furnaces on the floor above.

The arrangement of the furnace room corresponds to that of the generator room below it. For each four generators there are six furnaces, but four being in operation at one time, the other two being reserve. These "Horry" furnaces, so called from their inventor, W. S. Horry, are of the continuous type. Each consists of a huge short cylinder, mounted to revolve slowly on a horizontal shaft. The periphery of this cylinder is closed by a number of cast iron slats, which are readily removable, so that the upper part of the furnace may be left open. The drum thus formed, a view of which is shown in the initial illustration, has somewhat the appearance of a short barrel on its side, with the upper staves removed.

As the drum is revolved on its axis from time to time by a worm and hand wheel, these slats are taken off from one side and replaced on the other, thus always leaving the top open. This drum is filled on one side with the mixture of finely powdered coke dust and lime, and into the mixture the carbon electrodes project downward. A current of 2500 amperes is passed through the lime and coke, which fuse together and, as the drum revolves, lowering the mass from the electrodes, the fused matter cools and hardens and is broken off and removed as a stone-like mass, calcium carbide, as it rises on the other side of the furnace. New dust is constantly shoveled in to maintain the level around the carbons.

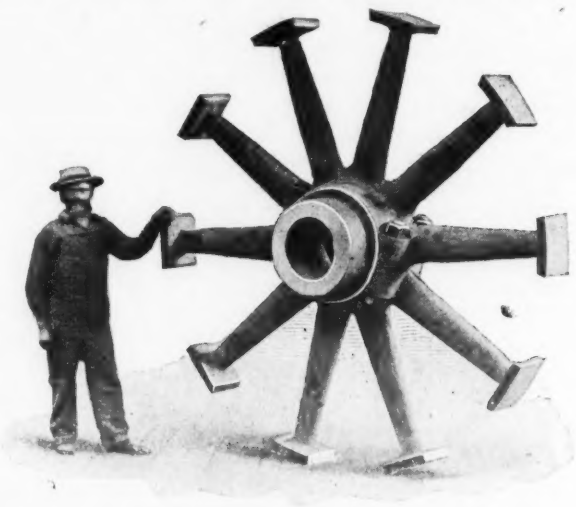
The most interesting portion of this plant from an electrical point of view is the battery of Walker alternating-current dynamos, which will generate the current. The machines themselves form, it is said, the largest single order for alternating machinery ever placed. The generators are of 500 horse-power, or 375 kilowatts each. They are of the single-phase,unitooth, 60-cycle, internal revolving field type, and are to run at 240 revolutions per minute. Each machine will deliver about 2000 amperes at 200 volts pressure.

It should be noted that they differ from the type previously used by the Walker Company, which comprised a field ring excited by a single-coil concentric with the shaft, this style being generally designated by the name of the company which first developed it for the now classical Lauffen-Frankfort experiment—namely, Messrs. Brown, Boveri & Co. The new type follows closely standard American practice, each pole having its own exciting coil.



Stationary Armature Ring and Detail Views of Field Core, Armature Coil and Field Spool.

The leads from these machines go directly to the switchboard without a sliding contact of any kind, the fields being excited by the current from an auxiliary dynamo taken through the collecting rings shown in the illustration.



Spider of Rotating Field.

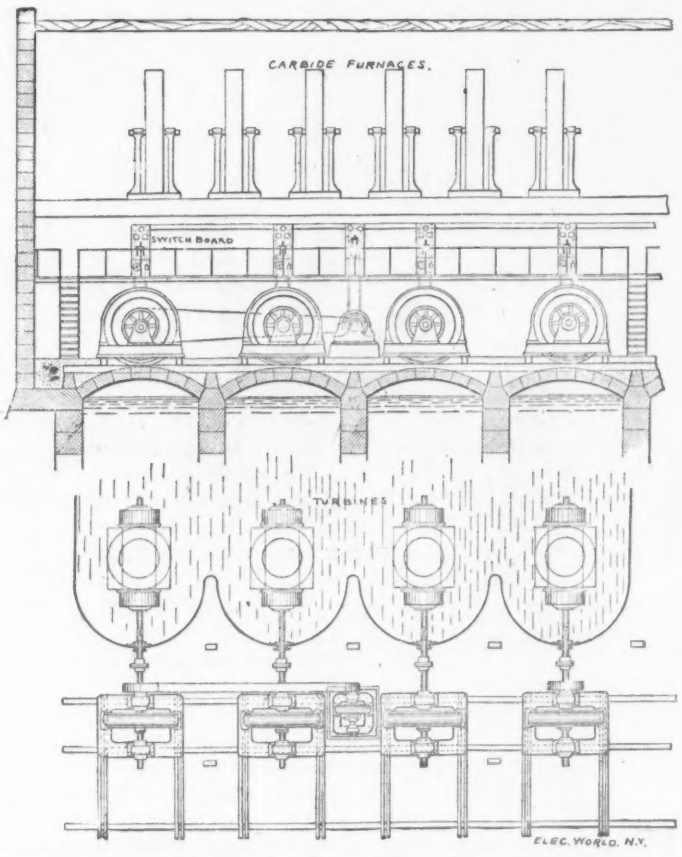
The stationary armature ring consists of two halves containing the toothed and laminated core, which is thoroughly ventilated. Each half in turn consists of two side plates, holding between

them the laminations of the core, and the halves themselves are bolted together in much the same manner as the field magnet of a direct-current machine. The arrangement of the armature slots is of interest, there being a narrow tooth between the near sides of adjacent coils. The armature coils are formed before being placed in position between the teeth of the core. A photograph of the armature ring, with two of the coils in place, is shown herewith, the armature coil itself formed ready to be placed in the slots and a laminated field core and unwound exciting spool being separately shown.

ASSEMBLED MACHINE.

The revolving field is built up on a spider, shown in one of the illustrations. On the arms of this spider is bolted a steel ring completely surrounding it, and on this ring in turn are bolted the laminated poles or cores of the field coils. The capacity of each generator in carbide will be from 3 to 4 tons in each twenty-four hours.

The machines just described are, of course, built for low tension and a very large amount of current. Slight modifications, however, serve to adapt them for power and lighting; in fact, several thousand horse-power of generators of precisely this type are now being built for railways and lighting stations at the Cleveland works of the Walker Company.



ONE GROUP OF MACHINES AND FURNACES IN PLAN AND ELEVATION.

The plant of the Union Carbide Company will undoubtedly become one of the most interesting of all those now building in the new manufacturing centre at the "Soo." The presence of unlimited water power in these days determines more than shipping advantages the direction of new industrial growth, and the Union Carbide Company seems to have chosen its location with a happy combination of both shipping and manufacturing facilities.

Electrical Equipment for the Volunteer Engineers.

The first of the three regiments of volunteer engineers has already enlisted about 1100 men and is at the time of this writing in camp at Peekskill, N. Y. The first battalion will probably be ordered to the front before this paper reaches its readers. It has been proposed by some of those interested in the welfare of the regiments that they be equipped with several engineering appliances new to the army and for which therefore no Government appropriations are available. It is especially desired that the brigade be provided with portable electrical searchlight equipments. One such piece of apparatus can be procured complete in a self-contained unit for about $3000. The employment of a searchlight in the army would be a novelty, but if of any use at all its success would be assured in the hands of competent engineers. It is argued that its field of application would be wider than in the navy, as it could be used in bridge and track construction and destruction, earth work, road making, repairing, searching the field for the wounded, hospital and headquarters work, etc., wherever such work was done at night. It is proposed that a fund be started for the purchase of such an equipment, and for any other apparatus by which the application of modern engineering science to the execution of military work can be tried in actual service under the most favorable conditions for a valuable test. Mr. O. F. Nichols, the secretary of the Volunteer Engineer Committee of the Engineers' Club, 374 Fifth Avenue, New York City, will receive subscriptions for this purpose. The Engineers' Club has also voted to tender to the regiment under the command of Col. Eugene Griffin, a stand of colors, the flags to be paid for out of the treasury of the club.

Electric Torpedo Boats.

BY CHARLES T. CHILD.

THE very interesting problem of the electrical operation of torpedo boats has been briefly discussed in these pages, but without bringing out fully the very great advantages of such a method for the operation of these terrors of marine warfare or the enormous difficulties in the way of a successful solution of the problem. To fully understand the necessities of torpedo boats it is necessary to give some account of the history of their development and the tactics prescribed at present for this use.

The first craft that can be called torpedo boats were used in the American civil war, both parties to that struggle making use of them with such success that they became recognized as offensive naval weapons on all sides, and their development as legitimate naval accessories was begun simultaneously in the shipyards of several of the maritime powers of Europe. The torpedo of that day was the "spar torpedo," a quantity of explosive attached to a spar and fired by contact with the hull of the enemy's vessel or by electrical means when brought sufficiently close to accomplish its purpose. Before the days of rapid firing guns this method of attack was much more often successful than now seems possible, as many instances in the war of 1861-65 attest. Even rowboats were used, and under cover of darkness or fog these small steam launches acounted for many vessels of the belligerents in that conflict. No less than thirty vessels belonging to the Federal authorities were destroyed or disabled by torpedoes during the four years of the civil war.

It was not for several years that the torpedo boat as a separate type of naval construction was seriously undertaken. The first steps taken in this direction were in England, where two famous builders, competing with each other ,turned out craft of about 7½ tons, with speeds as high as 15 knots. This was in 1873, and in 1878 boats of 75 feet length and 18 knots speed were the standard.

The automobile torpedo was introduced and developed simultaneously with these early types of torpedo boats, and in the course of a few years had made such progress as to find advocates in several navies. Still the spar torpedo held its ground, however, and it was not until the introduction of rapid-fire guns of great accuracy demonstrated the impossibility of a successful torpedo attack of this sort that the spar gave way to the launching tube for the automobile torpedo as the proper equipment for this class of vessels.

For twenty years the progress of torpedo boat construction has been marked by a gradual increase in the size of the boats and an enormous increase in their speed, and has been attended by the development of at least three types of these boats, differing in size, speed and armament, and intended for widely different uses. The engines of 90 horse-power and locomotive boiler of the early types have given place to the water-tube boiler and high-speed, triple-expansion engines of 6000 horse-power of the modern "destroyers." An almost equally great development has brought the torpedo itself to its present standard of great perfection.

The conditions of torpedo warfare are best summarized as the attack upon a large costly vessel by a small and inexpensive one, and the risking of a relatively small amount of property and lives in the effort to destroy a relatively large amount. The fear of such an attack has produced the type of large and fast torpedo boats adapted to attack and destroy other torpedo boats, and called in the English navy "destroyers."

All these types of vessels are necessarily of the highest attainable speed, sacrificing for this essential all forms of protection and nearly all defensive weapons. They are practically certain of destruction if discovered, but their protection is in their small size and attendant small visibility, and in their ability to run away from a dangerous neighborhood. Discovery means certain failure and probable destruction, so that the chosen hour of the torpedo boat is the dead of night, preferably when the obscurity is heightened by rain or fog. It has recently been demonstrated that the torpedo boat is useless and helpless and foredoomed to destruction in a daylight attack.

The reason for the high speed demanded of these boats is that they may overhaul their prey, and that they may escape if detected. It is, however, very much to be doubted if speed attained by the sacrifice of invisibility is desirable. For harbor boats, or those whose function is to attack blockading vessels or vessels under ordinary way, the highest speeds are not necessary for purposes of attack. For flight, the higher the speed the better the chances of the boat and its crew, of course, but if the higher speed is attained by the use of a larger and more readily discovered hull it will avail the boat little in these days of searchlights and rapid-fire guns. It seems, therefore, that all the considerations point to the necessity of keeping the size of the boats small and doing this even at the sacrifice of some speed. It must not be forgotten that these boats have nothing to fear as long as their movements are secret, but that as soon as they are discovered they become targets for the fire of machine guns and other quick-firing small pieces, whose ranges are far greater than the striking distance of a torpedo.

Outside of the "destroyer" type there have been developed two types of boats, sea-going and harbor-defense boats, whose names sufficiently indicate their differences. The sea-going boats are larger and of deeper draught than those intended for harbor and coast line defense. The latter need not go far from their base of supplies, and hence have no need for a large coal carrying capacity. The sea-going boats must be heavy enough and large enough to withstand rough weather at sea, and must contain sufficient fuel capacity for any ordinary cruise. While there is no very sharp line of demarcation between the two, it is generally recognized that boats smaller than about 140 feet over all and about 110 tons displacement are not fitted for long voyages.

The necessities for a harbor defense boat are good manœuvring qualities, fair speed in deep and shallow water, the smallest possible draught and a sufficient armament. The gun armament of such a boat may be reduced to very narrow limits, the only antagonists for which it is provided being small boats or other torpedo boats. A battery of two or three machine guns fulfills all the requirements. The advantage of shallow draught is the ability of the boat to elude pursuit by going into shoal water where the enemy cannot follow.

These considerations have been carefully worked out by the designers of steam-driven torpedo boats, and the results that have been attained challenge the warmest admiration. The table below gives some data of typical modern boats.

Name.	Navy.	Length.		Displacement.	Speed	I. H. P.	Weight of Hull.	Weight of Machinery
		Ft.	In.	Tons.				
Cushing.....	United States.	137	6	105.3	22	1760	33.7	54.5
Farragut.....	United States.	210	0	240	30	5600	85	120
Porter.....	United States.	175	6	165	28½	3400	56.5	76.8
Aluminum.....	France.	60	0	9.5	20½	300	2.0	4.5
Forban.....	France.....	144	3	124.8	31	3945	45.39	62.67
Sokol.....	Russia.....	190	0	240	29¾	3700	....	....
Virago.....	England	210	0	300	30	6425	....	144.3

It will be seen that a performance as good as one indicated horse-power from 5 pounds of propelling machinery has been attained—propelling machinery including boilers and water, piping, engines, pumps and condensers. The weights of stacks, screws and shafts are included in the weights of the hulls.

In attempting to design a torpedo boat for electrical propulsion it must be remembered that there can be little or no further reduction in the weight of the hulls. The problem resolves itself into replacing the steam machinery with electrical machinery of the same or less weight, which shall give results sufficiently better than those already attained to warrant the substitution. At the first sight this appears impossible, but the factor of visibility is the most important to consider, and with this the general effectiveness of the two types of boats.

Assuming that two boats of equal size and speed are driven respectively by steam and electricity, the electric boat will have an almost immeasurable advantage in her freedom from smoke, steam, noise and possibility of flaming smokestacks. In all the types of steam torpedo craft now in use forced draught is resorted to for the attainment of the highest speed, and this very often means that unless the greatest care is used a flame is driven out at the stacks instantly proclaiming the presence of the boat and lighting the way for its destruction. This has happened in actual warfare, as at the attack on Wei-Hai-Wei by the Japanese torpedo boats in the

recent Japan-China war. At that battle the attacking torpedo boats flamed under their forced draught, and in a few seconds were targets for a fire so hot that but for the incredible badness of the Chinese gunnery they would have inevitably perished.

Perfectly free from this danger the electric boat has the further great advantage of having no smoke stacks, which add to the visibility of the steam craft, and no smoke to make it evident to the eyes or noses of the watch on the attacked vessel. Having no boiler or steam pipes it cannot be put hors de combat by a single shot through its upper works, as was the Spanish Terror at San Juan de Puerto Rico recently. Indeed, all the machinery of an electric boat can be put below the water line, so that in a smooth sea the upper works of such a vessel could be riddled with shot without putting the boat out of service if enough of her crew were left to operate the machinery.

Of two vessels alike in other respects that one having the greatest manœuvring ability and the quickest response to the desires of her navigator will be best suited for torpedo purposes, and it is in this direction that the advantages and superiority of the electric boat are pre-eminent. There is no necessity for any sort of intermediate signaling between the conning tower and the helm or engine room on the electric boat, for steering and speed regulations as well as direction are in the hands of one man, through the agency of small appliances not more difficult to work than a street-car controller.

For this summary of the more apparent advantages of the electric type it is at once seen that the gain in secrecy will compensate for the loss in speed that is entailed; for it is not possible to develop a horse-power for any length of time with 5 pounds of any sort of electrical machinery now in vogue. There is also a difference in cost of construction in favor of the steam vessel, while the difference in cost of operation is largely in the same direction. The radius of action of the steam type is also much greater, but despite all these sacrifices the superior secrecy of the electric boat, its manœuvring power and instant control and its safety from annihilation by a single well-directed shot leave the balance in its favor.

After this somewhat lengthy preamble the discussion of the various types of electric boats may be condensed into comparatively small space. Taking a definite example is probably the best way to bring out the nature of the problem offered to torpedo-boat designers who attempt to supersede steam by electricity.

Of recent torpedo boats the U. S. S. "Davis" is an excellent type of the small sea-going variety. This vessel is 146 feet long, 14 feet 6 inches beam and about 5 feet 2 inches draught. Her displacement is 110.4 tons, coal capacity 40 tons, radius of action at cruising speed about 4000 nautical miles, horse-power (indicated) 1750 and speed 22½ knots. She carries two triple-expansion engines and two Thornycroft boilers. The engines and condensers, with their accessories, weigh 30.22 tons, and the boilers and their accessories weigh 26.78 tons. The hull weighs 42.6 tons. The armament consists of three 18-inch torpedo tubes and three 1-pounder rapid-fire guns. The boat has quarters for four officers and twenty men.

Suppose the motive power equipment of this boat to be replaced by electrical machinery for the same purpose of the maximum power for the allowable weight, what would be the result as to the speed, visibility and effectiveness of the boat?

There are two methods of supplying electric energy to the motors that work the screws—from primary batteries or from accumulators. It is well to look closely into the relative value of these for this purpose, of course without reference to the cost of operation. Singularly enough, for service of this sort, cost of operation is a factor not to be regarded unless so high as to be utterly out of the question. Success is what is demanded of torpedo boats, even if the cost be very high.

The motor equipment should consist of four motors of 400 horse-power each, weighing about 7000 pounds each. These motors would be of a two-pole type, having forged or laminated iron fields of simple shape, and provided with powerful ventilating devices, for it is proposed to work them at their utmost maximum. Their speeds would range up to about 1500 r. p. m., which would necessitate an arrangement of several screws on each shaft, such as experience with the "Turbinia" has shown to be desirable with very high speed propelling machinery. The aggregaate weight of these motors would be 28,000 pounds or 12.9 tons. The propelling machinery and coal of the "Davis" weigh, together, 97 tons, so that in replacing this with electrical machinery of the same weight the allowable weight for batteries, controllers and wiring is about 84 tons, or 188,160 pounds. Assume first that primary batteries are used. It is well known that of all types of primary battery the element using zinc and black oxide of copper in a solution of caustic alkali gives the largest output of energy for the total weight of materials. In such a cell the materials combine exactly when they are in the ratio represented by the following weights: Zinc, 17 pounds; copper oxide, 24 pounds; caustic (70 per cent.), 21 pounds; water, 60 pounds. These quantities are capable of giving an output of 4800 watt-hours, or 6.4 hp-hours; assuming the average e. m. f. to be 0.75 volt. The cells should be designed of the largest size consistent with easy handling, and yet not too large to reduce their number and the terminal e. m. f. to such a point that the current output becomes difficult to handle. The mean seems to lie in cells of about 30x30x26 inches size over all. If these are made up in sheet-iron composition-lined tanks, each containing eleven zinc plates and ten copper oxide plates, 18 inches square, they will weigh, complete, with connectors (aluminum) and covers of iron and porcelain, about 1500 pounds, and each cell can give 1000 amperes at 0.75 volt for 6.4 hours.

Using such cells as these it is seen that the "Davis" could carry about 116 of them, allowing about 14,000 pounds for controller and circuits. This would give only 116 horse-power for 6.4 hours, or 730 horse-power for one hour, corresponding to a speed of about 13 knots. Of course, this figure, coupled with an endurance of only one hour, makes this kind of equipment out of the question, the figures being given merely to show its fallacy.

With storage batteries the case is somewhat different. Among the various types of light batteries adapted to withstand large discharge currents which have been brought out for traction and automobile vehicles the lead-zinc-cadmium cell of Werner seems as promising as any. This cell consists of a positive plate of the usual lead grid type, and a negative plate of zinc, the electrolyte being a solution of cadmium and zinc sulphates with a little magnesium sulphate. In recent trials of electric carriages equipped with this battery thirty cells weighing 334 kilograms gave thirty amperes for six hours. This rate of discharge corresponds to about 1.5 horse-power after allowance is made for all losses in the motor and circuits. At this rate of discharge, then, the battery gives 1.5 horse-power for six hours from 735 pounds of cells, corresponding to 6.5 horse-power for one hour from the same weight, or 1 horse-power for one hour from 113 pounds of cells, these figures making allowance for the less capacity of the battery at a high rate of discharge. Assuming that the "Davis" can float 175,000 pounds of batteries, this means that with cells of this type the mechanical energy at the screws would be 1530 horse-power if the battery is discharged in one hour, corresponding to a speed of about 22 knots. This would be the rush speed for attacking. The battery could maintain an effort of 250 horse-power, corresponding to a speed of about 10 knots, for more than ten hours, thus giving the boat a cruising radius at that speed of about 100 nautical miles. It will thus be seen that the electrical equipment of the boat has cut down its radius of action from 4000 to 100 miles, left its speed unchanged and decreased its visibility by a considerable amount. If it be assumed that the distance at which the vessel become visible is that at which its area of exposed surface subtends a certain definite solid angle, this boat with its new equipment could come 1.47 times closer to the enemy than before without danger. This figure does not include the area of the smoke that is certain to be given out by the steam apparatus, nor does it make any allowance for the chance of flaming funnels.

By sacrificing so much of the cruising radius that the vessel is tied closely to its base a gain of a considerable amount is made in both invisibility and the manœuvring power of the boat, while its attacking speed is but slightly diminished. It seems therefore that the value of this boat, once in action, is much greater than when equipped with steam machinery, but that its ability to get into action is limited on account of its small cruising radius. The obvious remedy for this trouble is a tug. Such a boat if needed for service at a distance could be towed at fair speed to a point near the scene of operations, to which it could return after completing its mission. ,Naturally, such a boat would be useless as a dispatch boat or patrol boat, but for its purely legitimate functions as a torpedo boat there is no question at all that it is a better boat than if equipped with steam machinery.

Electricity as a Branch of Physics.

The important place which the branch of electricity has taken in the general science of physics is well shown in the June number of that excellent English publication, "Science Abstracts," which contains a large number of abstracts of articles of which all but a very small number are on electrical subjects.

The Electrolytic Production of Soda and Bleach by the Hargreaves-Bird Process.*

For many years past attempts have been made to replace the present cumbrous and circuitous methods of producing soda and bleaching powder by one in which common salt is decomposed directly into its constituents—sodium and chlorine—by means of the electric current. This done, it is easy to carbonate the former, and to make bleaching powder by passing the chlorine into leaden chambers containing lime, which absorbs the chlorine. The old Leblanc process is, of course, a very roundabout one. Solid salt is converted into sodium sulphate by means of sulphuric acid, hydrochloric acid being formed at the same time. The latter is next decomposed by means of manganese, yielding chlorine, which is absorbed by lime, to make bleaching powder as already explained. The sodium sulphate is converted into the carbonate by roasting it with coal, the salt being finally purified by crystallization. The ammonia process of producing the carbonate, which has proved so efficient in practice, labors under the disadvantage of not affording a ready means of converting the chlorine of the salt originally used into bleaching powder.

On paper nothing can be simpler than the electrolytic method of preparing soda and bleach, while in practice no operation has proved more illusive. It is essential that the sodium produced by electrolysis shall be prevented from redissolving in the electrolyte. A method of doing this is to use mercury as the cathode. The sodium dissolves in this, and can be afterward easily recovered as hydrate or carbonate. It seems, however, that for successful working pure salt is needed in the first instance, as small traces of magnesium, for example, cause sickening and consequent loss of the mercury. Other inventors have substituted molten lead for the mercury, with apparently some success.

The most original plan of electrolysis would seem, however, to be that due to Messrs. Hargreaves and Bird, in which the use of mercury, molten lead, or similar liquid cathodes, is entirely dispensed with; and we have recently had an opportunity of inspecting the working of a large cell at the works of the General Electrolytic Parent Company, Limited, at Farnworth, in Widnes. The Hargreaves-Bird cell consists in the first place of a carbon anode, placed between diaphragms, which form two sides of a cell containing the electrolyte. Outside the diaphragms, and thus out of contact with the electrolyte, are sheets of copper gauze which form the cathodes of the cell. A current of steam and carbonic acid gas is kept passing over these sheets of gauze, and the former condensing between them and the diaphragms provides a passage for the current between the diaphragm and the gauze, and thus completes the circuit between anode and cathode. As the current passes in, metallic sodium appears on the outer wall of the diaphragm, where it is converted to sodium carbonate by the combined action of the steam and the CO_2 already mentioned, and, dissolving in the condensed steam, trickles down the outer face of the diaphragm, and is collected and drawn off below. By regulating properly the steam supply, the solution can be obtained in a saturated condition, but in practice it is found advisable to work with a small excess of moisture, as otherwise solid sodium carbonate is liable to be deposited between the gauze and the diaphragms, separating the two.

The important feature of the cell is to be found in the diaphragms. These are made out of asbestos, sodium silicate and other undisclosed constituents, the method being to reduce the whole to pulp in a beater, and then, as in paper making, to flow it over a piece of muslin, supported on a carefully leveled piece of wire gauze. The excess of water being drained off, the sheet remaining above the gauze is dried in an oven, preferably heated with steam, and is then pickled for a short time in a solution of sodium silicate, after which it is ready for use in the cell. The whole of these operations can be performed very rapidly by unskilled labor. The diaphragms thus produced are not porous in any ordinary sense of the term. When the current is not passing through the cell, there is no filtration of its contents through the diaphragm. Nevertheless, during electrolysis it is found that the sodium ions penetrate without difficulty, and collect on the external wall, as already described.

The cell installed at Farnworth is about 11 feet long by about 6 feet total height. The diaphragms measure 10 feet 4 inches long by 5 feet 4 inches high, the active surface of each being 10 feet by 5 feet, or 100 square feet in all, there being two to the cell; the thickness, we may add, is about one-eighth of an inch. The total width of the cell, including projecting bolts, is about 3 feet. This cell is capable in daily work of decomposing 240 pounds of salt (Na Cl) per twenty-four hours, giving in the same time about 216 pounds of soda ($Na_2 CO_3$) and 360 pounds of bleaching powder.

A pump is used to circulate the brine through the cell. The liquor entering at the bottom passes out through an overflow, taking with it the chlorine generated at the anode. This chlorine is collected in a separating tank and drawn through a line chamber of the ordinary pattern by an aspirator. Finally the chlorine escaping from this chamber is passed into a scrubber, where, meeting a solution of crude soda, it produces sodium chlorate, which is collected at the base of the apparatus. It is stated that in this cell crude brine can be used as the electrolyte. The earthy impurities, etc., are deposited on the inner faces of the diaphragms, but do not sensibly affect the proper working of these. In general a diaphragm is run about a month without renewal, though this period has at times been greatly exceeded.

The electrolytic efficiency of the cell is astonishingly high, independent reports by Professor Ramsay, Messrs. Cross and Bevan and Messrs. Norman, Tate & Co., all showing that over 97 per cent. of the current is employed in useful electrolysis. The carbonate obtained was found by these gentlemen to contain less than 2½ per cent. of impurities. The electromotive force at the cell terminals is about 4 volts, and the working current density is 23 amperes per square foot.

The construction of the anodes should also be referred to. These consist of a series of rough blocks of gas carbon measuring, say, 15 inches by 7 inches by 1½ inches, strung on a copper rod, a special cement being used to keep the chlorine away from the copper. A number of these sets of carbons connected in parallel form the anode of the cell. The company states that anodes thus made have been used without failure for periods of over twelve months.

*From London "Engineering."

A Meter with Valuable Properties.

The London "Electrical Engineer" describes a new alternating current meter with some remarkable features. The instrument is of the induction type with a shunt exciting circuit, giving a cross magnetization. The energy wasted therein is stated to be only about 1 watt. The cross magnetization is obtained at a phase difference of 90° from the impressed voltage by shunting the cross-magnetizing winding by a non-inductive resistance, the two being in series with an inductive resistance across the mains. The statements of the accuracy obtained are astonishing. The maximum error, with loads ranging from 2 per cent. to full load, being less than 0.6 of 1 per cent. The braking is effected by a Foucault disc working between permanent magnets, and, to obtain extreme sensitiveness on light loads, a small torque on no load is obtained by the shaping of the poles, this torque being resisted by a small piece of iron wire on the brake disc. This iron wire is attracted by one of the permanent magnets holding the disc stationary on no load, but the slightest load serves to overcome the attraction which obviously, once the mechanism is in motion, gives no retarding effect as would mechanical friction.

Vacuum Drying.

The English electrical journals briefly describe an apparatus said to be quite widely used by the leading electrical firms in Germany for the drying of the insulation of electrical coils, dynamo armatures, etc., at low temperatures, by means of a vacuum. The apparatus consists simply of a cast-iron chamber closed by doors hermetically sealed with india rubber gaskets, and arrangements for obtaining a vacuum of 28 inches of mercury or more and for heating the chamber proper by steam or hot water. At a very moderate temperature, about 95° Fahr., water evaporates more rapidly under this condition than at temperatures under atmospheric pressure high enough to injure the insulating properties of organic substances through carbonization. With a high vacuum it is stated that materials can be thoroughly dried at as low a temperature as 63° Fahr. It is said that English cable works have used a similar process for jute and paper insulated cables as well as washed india rubber for some time.

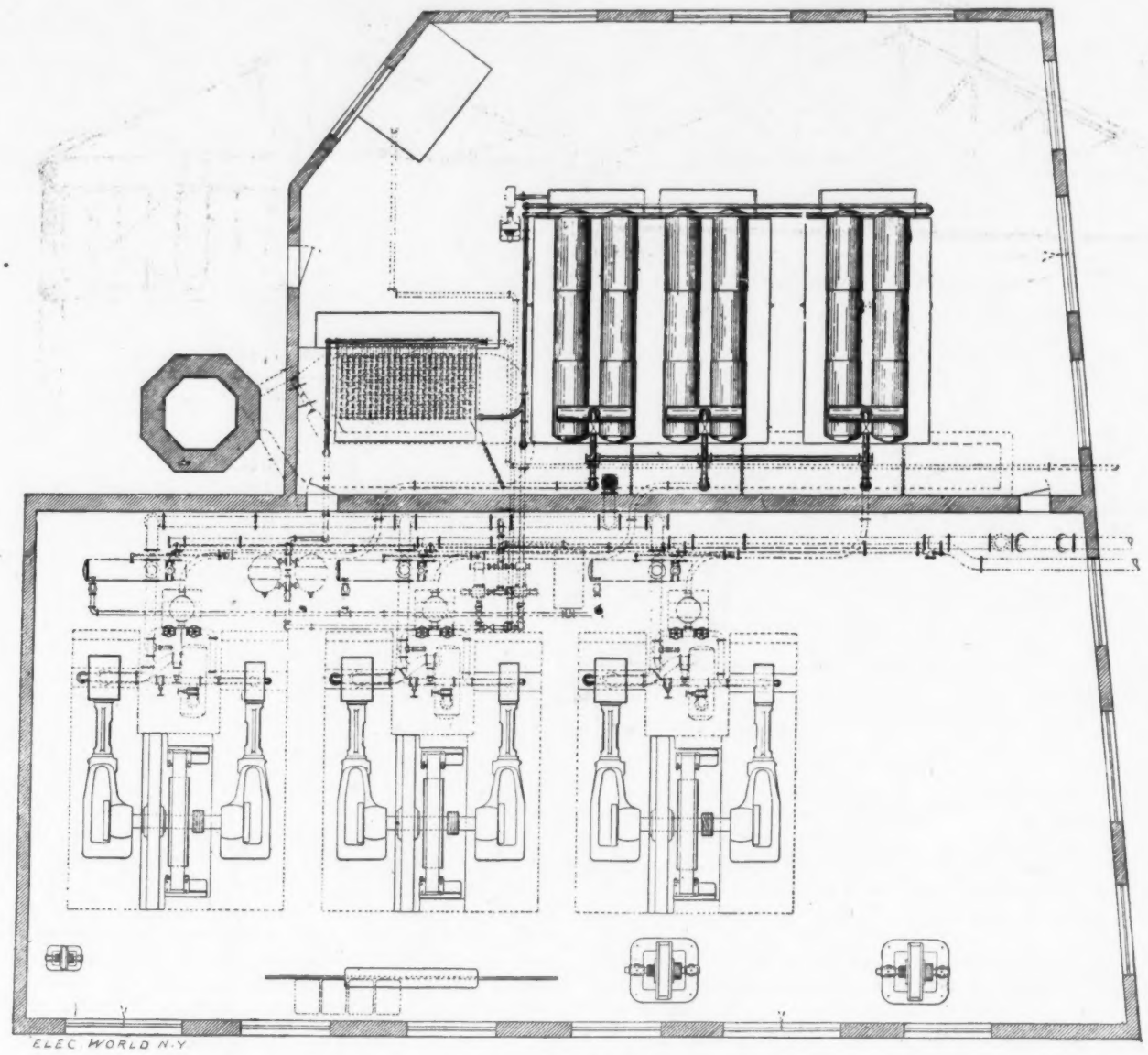
The Middlesbrough, Stockton & Thornaby (England) Electric Tramways.

The Imperial Tramways Company, Limited, of Bristol, England, has issued an elaborate brochure of its newly equipped lines connecting the towns above mentioned, the electrical features of which lines are quite unusual in some respects. The system comprises at present a total track length of 15 miles, while other lines are proposed which will add about 20 miles more. The tracks are of a 3-foot 6-inch gauge, laid on a solid foundation 6 inches deep of Portland cement concrete, the whole roadbed, after the rails were laid, being floated in cement. The rails are 6-inch girders, 92½ pounds to the yard.

The central power station, located on the water front at Stockton-on-Tees consists of two brick-wall steel-roof frame structures with monitors, as shown in the accompanying illustrations, one forming the boiler room and the other the engine room. The coal is discharged from the vessels by an electric crane on a wharf, into a hopper, where it is weighed in 3-ton lots, after which it is automatically hoisted and discharged by an elevator or conveyor, with a capacity of 20 tons per hour, into the storage bunkers of 300 tons capacity, from which it is fed by gravity into the hoppers of the mechanical stokers, and so into the furnaces.

The engine room has a basement below the ground floor, and this floor is supported upon iron girders, with boiler plates between them, concreted to floor level, and finished with artistic marble mosaic tiles, with borders in keeping. The condensing and pumping plant is arranged on the basement floor, and all steam condenser, suction, and other pipes and connections being also carried below the floor line, a clear space is thus obtained around the engines and generators. The engine foundations, of which there are three, are built in solid concrete from the basement floor level. The engine room measures 110 feet by 52 feet, and has a clear space of 36 feet from the floor to the tie bars of the roof principals. The boiler room is 78 feet by 48½ feet, and is of the same height as the engine room. Here there are provided three Babcock & Wilcox water-tube boilers, each having a heating surface of 3580 square feet, and being capable of evaporating 12,000 pounds of water per hour.

The smoke stack, which is 132 feet in height and 7 feet diameter at the top, is octagonal in section, and is built of best pressed brick and lined with fire brick. In the flue leading to it is placed a Green economizer of 240 tubes. The boilers supply steam to three Reynolds-Corliss horizontal cross compound condensing engines of 400 horse-power each, made by the E. P. Allis Company, of Milwaukee. Each engine is directly coupled to a dynamo of the three-phase type, of 300-kw capacity, 32 poles, 2500 volts, giving a frequency of 25 cycles at 94 revolutions per minute. The fields are excited from the 500-volt bus bars. To supply light when the machinery is stopped and to start the dynamos in the morning a battery of accumulators has been provided. These were made by the Tudor Company, and consist of 260 cells, with a discharge rate of 48 to 70 amperes; the capacity, at the lower discharge rate, being 240 ampere hours. For charging these accumulators, a booster is connected in series with the 500-volt bus bars. This booster consists of a rotary converter fed from step-down transformers of special design. Each transformer has the primary and secondary separated, so as to give the effect of a considerable reactance, this



PLAN OF POWER HOUSE.

arrangement giving a large range of voltage on the rotary converter to provide for the alteration in the charging volts required by the cells.

The system of distribution is designed to give the maximum of power at any point of the system on the most economical basis. A 500-volt, continuous-current direct from rotary converters in the main station feeds the trolley lines for 2 miles on either side of the station, while the Middlesbrough and Linthorpe sections of the lines are fed by three-phase power transmitted at 2500 volts from the main station to the substation at Newport, and there transformed down so that power is delivered from this subcentre direct into the line at 500 volts.

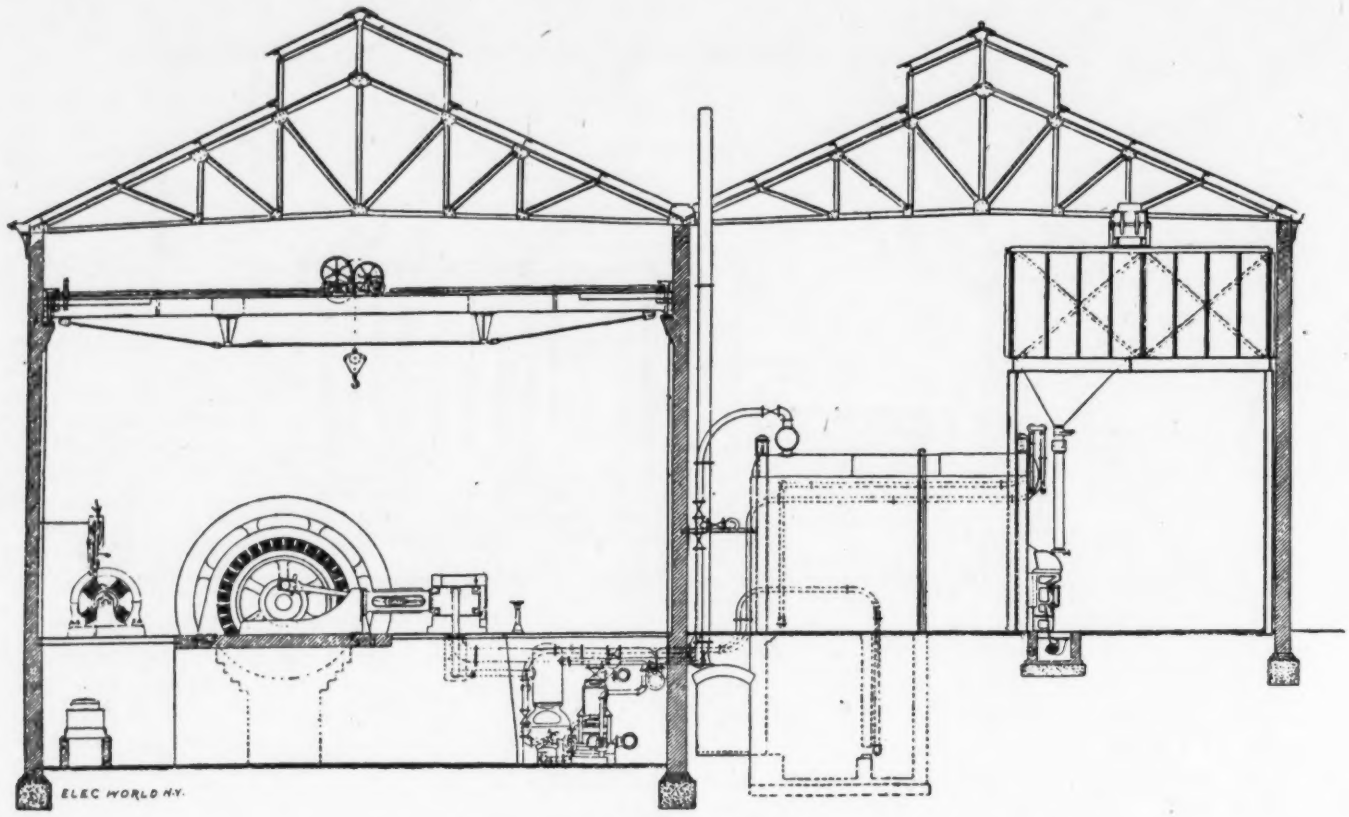
The Board of Trade regulation with respect to the return current is that the difference of potential between the generating station and extreme ends of the line shall not exceed 7 volts. The multiphase distribution was adopted partly for this reason. A further advantage lies in the comparatively small amount of copper required in the feeders conveying current to the trolley wires. The 7-volt limit in the earth return is fixed by the Board of Trade for the purpose of protecting gas and water pipes against the possible electrolytic effects of stray currents. With a single point of distribution only, the earth currents would always flow toward the generating station, but with more than one point of distribution the current along the line may be in opposite directions at different times, according to the distribution of the load; and thus the risk of electrolysis is greatly reduced.

The feeder which transmits this three-phase current at 2500 volts from the central power house to the substation consists of two concentric cables, in each of which are three conductors of copper suitably insulated, each conductor having an area of .0775 square inch. With this small section it is possible to transmit 300 kilowatts, with a loss of less than 5 per cent. At the substation this current is reduced by "step-down" transformers of 80-kw capacity to 320 volts; and this current is then passed into the alternating current side of a rotary converter, from which a direct current of 500 volts is drawn to feed the portion of line supplied from the substation. The two four-pole rotary converters of 200-kw capacity running at 750 revolutions per minute in the main power station feed direct into the portion of the lines supplied from that point, and three similar machines are located at the substation, from which distribution is made to the remainder of the system.

A novel feature of the main station equipment is a combination of stationary and rotary transformers for charging the batteries.

The charging current is passed through the rotary, and the pressure is raised from the line voltage of 500 to a maximum of 650 volts for charging. There being no direct-current primary generators in the station, it became a problem how to charge the batteries for supplying the excitation to the high-tension, three-phase generators.

This was solved in the following manner: A rotary converter was designed to supply the difference between the line voltage and the variable voltage required for charging; combined with this was a stationary transformer, having a ratio of transformation of 330 to 80 volts on a non-inductive load; the transformer was designed with a large amount of leakage between the primary and secondary, the leakage being adjusted so that, by changing the phase of the armature current by variation of the field current of the booster, the transformer ratio is varied, and consequently the voltage on the collector rings. In this way it is possible to vary the voltage on the continuous side of the rotary from 40 volts to 150 volts. The charging current is 60 amperes. The armature of the rotary is designed to carry 60 amperes continuously. All of the electrical apparatus was installed by the British Thomson-Houston Company, representing the General Electric Company of America.



Sectional Elevation of Power House.

Wanted—A Time-Limit Damper Controller.

A request has been sent to the editors of The Electrical World for directions as to where to obtain a damper controller so constructed as to close a damper which is opened at the time the fire door is opened at any pre-determined period (from one to eight minutes) after the fire door is closed. Any one constructing such an instrument will confer a favor on the editors by advising them of it.

Another Possible Use for Acetylene.

When acetylene gas is burned with an insufficient supply of air it gives a very dense smoke, owing to the large amount of carbon in the gas. The soot derived therefrom is said to be distinguished by a deep blackness, showing not the slightest touch of color, and it is suggested that this is excellently adapted for the production of high-grade printers' ink.

DIGEST OF CURRENT ELECTRICAL LITERATURE AMERICAN AND FOREIGN

By Carl Hering

Dynamos, Motors and Transformers.

ALTERNATOR DESIGN. Marshall. Lond. "Elec.," July 15.—A short note in which he shows that the diameter of an alternator rotor varies approximately with the output and voltage of the machine; the diameter in inches is given to a considerable degree of accuracy by the following formula: 30 plus one-fifth the output in kilowatts, plus the fraction 1000 divided by the terminal voltage; he suggests that this might be of considerable value as a rough guide to students. A table gives the actual and calculated value for eight different machines; the agreement is quite good.

TRANSFORMER FOR A THREE-WIRE SYSTEM.—"Zeit. f. Beleucht.," July 10.—An illustrated description of a transformer patented by the Union Company for supplying a three-wire secondary system from a two-wire primary. There are two primary coils placed symmetrically on the two sides of the same transformer; below each of these are two secondaries, the upper one on one side being connected in series with the lower on the other, and thence to the neutral wire connection, while the other upper one is connected to the other lower one, and thence to the neutral wire; by this sub-division of the secondary into four coils connected diagonally, the induction will be the same in both, even if the three-wire system is not exactly balanced.

STARTING NON-SYNCHRONOUS SINGLE-PHASE MOTORS. Arno. "L'Elettricita," 6, p. 265, and 7, p. 97; abstracted briefly in "Science Abstracts," June.—He shows that with a suitable resistance in the armature circuit a single-phase motor can be started by giving it a pull with the hand. In the second paper he describes a method to produce a dissymmetry in the armature at the moment of starting by opening the circuit of one of its windings; if the armature is not at a dead point it will rotate through a portion of a turn, and if the circuit is then closed there will be sufficient impulse to get the motor up to speed.

MAGNETIC LEAKAGE. Rothert. "Elek. Zeit.," July 14.—A brief reply to the recent criticism of Osnos (see "Digest," July 23).

ALTERNATOR FOR SEVERAL DIFFERENT VOLTAGES. Dahl. "Engineer's Year Book," Univ. of Minn., Vol. 6.—A short, illustrated article showing some modifications proposed by Shepherdson, in a 10-kw, 10-pole, single-phase alternator, so as to enable it to give different voltages. The coils, which are radial, have their terminals connected to blocks on the revolving armature frame in which screw plugs may be inserted so as to connect them in different groups, by means of which different voltages can be obtained.

MOUNTING ELECTRIC MOTORS.—"Amer. Mach.," July 14.—A short, illustrated article showing a typical method of mounting used in the Baldwin Locomotive Works, where many of the tools are driven by electric motors; the method is sufficiently flexible to apply to many cases. The motor is placed on a light angle iron frame bolted to the floor next to the machine, the driving being by means of very short belts and a short countershaft containing the cone pulleys; these short belts seem to be satisfactory.

PARALLELING CONTINUOUS CURRENT DYNAMOS. Springer. "Engineers' Year Book," Univ. of Minn., Vol. 6.—He shows the importance of the characteristics of the generators which are to be connected in parallel; he describes how these characteristics may be obtained and how they affect the paralelling; the internal and the external characteristics are discussed; he shows how compound generators are connected in parallel.

Lights and Lighting.

NERNST LAMP.—"Zeit. f. Beleucht.," July 10.—A short, illustrated description taken from a patent specification of his method of heating the material used for lighting, which becomes a conductor only after being heated, as has already been explained. One method is to surround the body with a coil of platinum wire, which is heated by means of a current. In the second method the rays are condensed on it from a reflector above the body, which is heated by means of a coil. In the third method the body is suspended from the movable coil of a solenoid through which the main current passes; before the body becomes a conductor its position is inside of the platinum spiral which heats it, but as soon as current passes it is automatically withdrawn from this spiral by means of the solenoid, so that the spiral is no longer in the way of the light.

TRAIN LIGHTING.—"Zeit. fuer Elek.," July 3.—A long, illustrated description of the Dick system of train lighting, which is used in Austria; other but briefer descriptions have already been referred to.

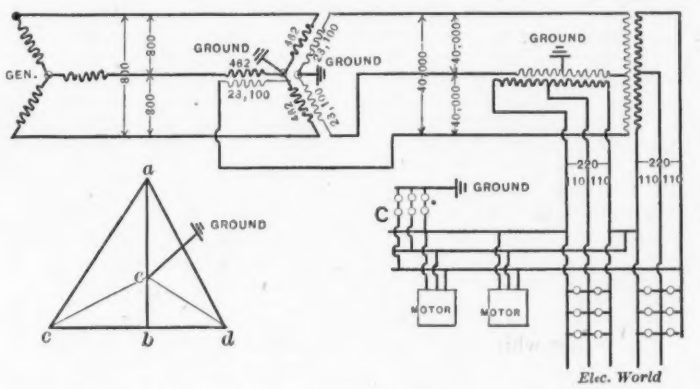
Power.

TRANSMISSION PLANT AT LES CLEES-YVERDON.—"Elek. Zeit.," July 14.—A long, well-illustrated description of this water-power plant, which is said to be one of the most interesting in Switzerland; it has been run for eighteen months and supplies twenty cities and villages with light and power. The three-phase system is used, with the primary in common and the secondaries partly in common for both light and power; the plant is designed for 1800 horse-power at the turbin shafts; the current is generated at 5200 volts, and a frequency of 50, the triangular system of connections being used; the total length of the primary circuit is 30 miles, and there are twenty sub-stations on one line and fifteen on another; the lights are distributed equally over the three-phases, and it has been found that unequal loading has practically no effect on the voltage; eighty motors are connected from 0.1 to 120 horse-power, representing a total of 750 horse-power; up to 2 horse-power they have short-circuited armatures and require no special starting arrangements.

PLANT AT CREUSOT.—Lond. "Engineering," July 15.—In this installment of a very long series on Schneider & Co.'s large iron works at Creusot, the central lighting station, railways and electrical products of that company are described.

STEAM POWER AND ELECTRICALLY TRANSMITTED WATER POWER. Saldini. "Elettricita," 17, p. 53; abstracted, with a number of the tables, in "Science Abstracts," June.—He compares the costs. He also shows that electric power has the advantage in economy only for the smaller motors up to 60 horse-power; but if the working day of nine hours can be increased the comparison is more favorable to electricity.

PROVOST-MERCUR 40,000-VOLT TRANSMISSION PLANT. Bly. "Jour. of El'ty," June.—An illustrated description of this plant, which is said to use the highest voltage of any plants where power is transmitted commercially over long distances. Experiments have been made with potentials ranging as high as 120,000 volts, and for which the line was a special one, having a length of 11,720 feet over a rugged country; it consisted of three circuits of galvanized iron wire; all the different varieties of cross-arms, pins and insulators found in the market were tested; up to the present time the results of these experiments have not been published. In the Provost-Mercur plant 2000 horse-power will be transmitted a distance of 32 miles to one place and 46 to another, the two places being 20 miles apart, and will be connected by another line so as to guard against accident to either of the others. At present there is only one 750-kw three-phase generator, driven by a turbine and giving 800 volts, which is raised to 40,000 by means of transformers; the copper loss in the 250-kw transformers averages about 2150 watts, and the iron loss about 3030 watts, the normal temperature at full load being 118° above the surrounding air. Three-phase generation, three-phase transmission, and two-phase distribution is the system used, and all the three-phase portions are star connected, the common centre or neutral point being grounded as shown in the adjoining diagram;



Elec. World

the two-phase distribution is also grounded as shown. The line consists of No. 5 B. and S. medium hard-drawn copper supported in the form of an equilaterial triangle with 6-foot sides; these wires are not transposed, and a metallic telephone circuit 42 inches below the cross-arms is used; the insulators are of a special type of triple petticoat glass, and are supported by long locust pins boiled in paraffin; should a wire ground on a pin or cross-arm it would promptly burn them off, leaving the wire free. About twenty-five lightning arresters are used, with six choke coils. The fuses in the high-tension circuits each consist of a single No. 30 B. & S. bare copper wire 36 inches long, over which is an asbestos tube; the high-tension switches, which are illustrated, give a 6-foot break. The connections of the step-down transformers are shown in the adjoining diagram, which also shows how the two-phase circuit is grounded, this point being located in the three-phase-two-phase transformers at one-third the turns of the 86 per cent. transformer from the side connected to the centre

of the 100 per cent. transformer. The 220-volt secondary is also grounded through lamps through incandescent lamps, as shown at C. A tap is brought out from the centre of each of the single phases of the two-phase system, and this forms the neutral wire of the three-wire system used for the incandescent lighting; this grounding is believed to free the system from danger to shocks.

BARTON.—"Elec. Eng.," July 21.—A short, illustrated description of the monocyclic transmission plant at that village in Vermont. The water power is transmitted 15 miles, which is said to be the greatest distance over which the monocyclic system has been used; there are two alternators of 100 kw, each delivering current at 1040 volts.

NIAGARA FALLS. Dunlap. "Elec. Eng.," July 28.—A brief, illustrated description of the extension in the plant at the Gorge; the first turbine of the extension has just been started; there will be five of these of 2500 horse-power each.

ELECTRICITY IN MINING.—"Jour. of El'ty," June.—The beginning of an article of a general character, the present portion referring chiefly to electric hoists and tramways, giving general hints; also a table of the performance and limiting dimensions of mining locomotives.

Traction.

AUTOMOBILES.—"L'Ind. Elec.," July 10.—The greater part of this extra large edition of that journal is devoted to this subject. In a brief introduction it is thought that this industry will become one of the most important in the closing century, and that its development is largely due to the Automobile Club, of France. It is thought that steam, oil and electricity each have their limited fields; steam is, and will be, the agency for heavy vehicles; oil is adapted for much higher speeds and long tours, and in special cases to the service in cities; electricity will, in the next century, be the agency for cabs and carriages for city traffic. The advantages and disadvantages of electric vehicles are compared, and it is thought that the latter are more than balanced. The next portion is a long article by Hospitalier, referring to the recent trials in Paris; the various carriages are described and illustrated, and in some cases with diagrams of the wiring; all except one were provided with pneumatic tires; all the electric vehicles used the Fulmen accumulators. The results of tests of these accumulators are given, the authority being Hospitalier; those used had thirteen plates to the cell, the complete weight being 7.5 kg; a continuous discharge of 5 hours is considered normal, and at this rate the capacity was 105 ampere hours; the rate is 40 watts at the terminals; this corresponds to 3 amperes per kg, and is equivalent to 26 watt hours per kg. From a number of the wiring diagrams it appears that the battery is separated into two groups, which are used in series, or parallel on some of the vehicles. This is followed by the results of the trials, which are given quite completely in numerous tables, including also the amount and cost of the energy used. In conclusion he states that these trials have proved that the electric carriage is possible, and that it is the only possible one; we may be satisfied if the experiences of the next year show that it is practical; after two years it will be established that it is economical. This is followed by an article on the international exhibition of automobiles which was held last month in Paris; this includes illustrated description of a large number of vehicles.

"L'Eclairage Elec.," July 9, also contains a long article by Blondin, giving the results of these trials and including a large number of tables.

"L'Elec.," July 9, also contains a short article on these trials; the results were perfectly satisfactory, showing that such vehicles are very well suited for cities. Most of them were electrical, and a few were run with petroleum; a list of the prizes awarded is also given; the Jeantaud electric vehicle received the first prize of $200 for two-seated carriages, and the Jenatzy electric carriage of this class received the second prize of $120; the Krieger electric carriage received the first prize of $200 among the carriages seating four persons.

WATERLOO AND CITY RAILWAY.—Lond. "Elec." and "Elec. Rev.," July 15.—A short description of this underground railway, which has just been opened in the city of London. It is probably the shortest city railway in existence, being only 1.45 miles long, with no intermediate stations, thus obtaining the full advantage of the down-grade at the start and the up-grade at the end, as the line passes under the river. The object of this line is to connect the London and Southwestern Railway station with the heart of the city.

TRAIN RESISTANCES.—Lond. "Elec. Rev.," July 15.—An abstract of a recent article in the Lond. "Engineer," including a formula proposed by Leahy.

ELECTRIC RAILWAYS. Pellissier. "Science Abstracts," June.—Brief abstracts of the series of articles noticed in the "Digest" which have appeared in "L'Eclairage Elec.'

ELECTRIC LAUNCH.—Lond. "Engineering" and Lond "Elec. Eng.," July 15.—A brief description of the one recently constructed in England for the Russian Government.

ACCUMULATOR TRACTION. Gilbert. "St. Ry. Rev.," July 15.—A short article in which he compares what was formerly known as the Englewood line, of Chicago, with those on which other systems are used; this line is said to be the only successful storage battery road in operation in the United States; the article refers to the operation of the line. The plant was designed for fifty cars, but only eight are run on week days and forty on Sundays and holidays; the weight of a car is 15 tons, and they, therefore, cannot start and stop as quickly as trolley cars weighing 8 or 9 tons; this did not, however, increase the accident account, which was only two-thirds of 1 per cent. of the gross receipts; an entirely different training of the motor men is necessary; they are instructed to coast as much as possible; a record of the condition of every battery is kept as it leaves the barn and returns to it, so that the amount of energy that each motorman has used is recorded. The snow plow weighs 22 tons and the sweeper 26 tons; they are satisfactory, a drift several hundred feet long and 7 feet high having been successfully cut through. The longest round trip is 22 miles, which is easily accomplished with one charge; as much as 40 miles has been run with one charge; the batteries, however, are ordinarily charged every half trip—that is, every 11 miles—the power plant being located at the centre of the system; the time for making a charge averages 1.25 minutes; the roadbed is nearly level the entire length, excepting a grade of 9.5 per cent. 300 feet long, which the cars will climb without assistance when the rail is dry; on a slippery rail a counterweight system is used. The cars average over 200 miles per day at a speed of 12 miles per hour; the cars ride very smoothly, owing to their great weight. Branch lines cannot be operated economically, as the cars must come back to the barn for a fresh battery so frequently; the wear and tear of the car and tracks is very much greater than with the trolley system; an 80-pound girder rail is used; the acid fumes have a most damaging effect on nearly all of the materials, including the insulation. The depreciation of the batteries is 2 cents per car mile and takes the place of that of the overhead work and bonding on a trolley road; the total operating expenses average 8.67 cents per car mile, ranging from 7 cents in the summer to 10 cents in the winter; this will be cut down, but even now compares favorably with that of the trolley system; he sees no reason why storage batteries should not be operated fully as cheaply as a trolley line; the first cost is greater, being, in this case, about $25,000 in favor of the trolley system, assuming a service of twenty cars.

NEW FORM OF CONTROLLER. Henry. "Elec. Eng.," July 21.—He mentions the many advantages claimed for his new "regenerative" controller, the description of which, however, is very brief. Among these claims are the following: 25 per cent. increase of capacity of motors; 40 per cent. increased efficiency; quicker acceleration; braking by returning current to the line; same speed for lower voltage at ends of long lines; electric coupling of the motors; greatly increased starting torque. It appears that separately excited shunt motors are used, and that therefore the waste in the series windings and the objections to them no longer exist; no resistance is used in the armature circuits, the regulation being accomplished with resistances in the field magnet circuit; rapid acceleration is produced much more economically than with series motors; the back kick due to the frequent breaking of the field circuit, which is so apt to pierce the insulation, is avoided by placing a non-inductive resistance of small carrying capacity in parallel with the fields whenever the armature circuit is open independently of the fields; in changing the armatures from series to parallel he short-circuits one of them with a resistance, leaving the fields excited; the E. M. F. generated is counteracted by the line current, thus allowing the circuit to be broken without flashing; the reversing is done by the fields instead of the armatures; the armatures for doing the same work carry 25 per cent. less current; arc extinguishing devices in the controllers are no longer necessary.

CAR MOTOR REGULATION.—"Elec. Eng.," July 28.—A short description of a system suggested by Hunter. It requires no resistance and controls the speed of the motors with the aid of a constant potential current which is varied in strength, and by interposing a varying counter E. M. F. independent of that of the motors; it is claimed to be of importance in the operation of large cars or trains; the forward part of the train is provided with a pilot car, which contains the necessary controlling devices.

ALTERNATING CURRENT TRACTION. Davis and Forbes. "Eng. Mag.," August.—An article which appears to be the first of a series, discussing the application of alternating currents to electric traction, and in which they point out the apparent limitations of the possible developments. The article is somewhat elementary in character; they show that the alternating current cannot well be used directly on the cars, but it may be used to advantage in some cases when the power is to be transmitted over a long distance and then transformed into direct current. The following data which they give may be of interest, as showing the small relative cost of the power, even a large saving of which would be only a small proportion of the total cost; a fair average of the cost of the power on an electric road is 11.5 per cent. of the total per car mile; of the cars 19 per cent.; of the track and line 27 per cent., and of the car labor 42.5 per cent.; the coal item is about 50 per cent. of the power cost or 5.75 per cent. of the total cost per car mile.

EUROPEAN ELECTRIC RAILWAYS.—"St. Ry. Rev.," July 15.—A short table taken from the article noticed in the "Digest" April 9, showing the mileage and number of cars for 1897 and '98 for each of the different countries in Europe.

GORNERGRAT RAILWAY.—"St. Ry. Rev.," July 15.—A short, illustrated article describing this three-phase mountain railway, to which a number of references have already been given.

PITTSBURG STREET RAILWAYS. Fairchild. "Elec. Eng.," July 21 and 28.—An article giving brief descriptions.

PARIS.—"Elec. Eng.," July 28.—A short, illustrated description from "La Nature" of the combined trolley and battery system used in that city.

UNDERGROUND FEEDERS FOR ELECTRIC TRACTION. Morris. "El'ty," July 27; reprinted from the Lond. "Railway World."—A short article discussing the two systems briefly and giving some hints.

ELECTRIC TRACTION. Quin. "St. Ry. Rev.," July 15.—A reprint of a paper noticed in the "Digest" July 16.

MOTOR CARRIAGES.—"Elec. Eng.," July 28.—A brief, illustrated description of the Columbia carriages.

MINING LOCOMOTIVE.—"Elec. Eng.," July 28.—A brief, illustrated description of a low mining locomotive made by the Baldwin and the Westinghouse companies.

Installations, Systems and Appliances.

BERLIN.—"Zeit. f. Beleucht.," July 10.—The first part of tabular extracts from the report of the city electrician, Kallmann, on the financial features of the central stations at Berlin.

MORLEY.—Lond. "Elec. Rev.," July 15.—An illustrated description of this alternating current station.

CENTRAL STATION ACCOUNTS.—Lond. "Elec.," July 15.—An analysis of the accounts of the Wolverhampton station.

220-VOLT SYSTEM. Gray. "Engineers' Year Book," Univ. of Minn., Vol. 6.—A short article giving a few general hints in connection with such plants. There are now about fifteen plants of this kind in operation in this country.

SWITCHBOARD APPARATUS. Blaikie. "El'ty," July 27.—A reprint of the paper noticed in the "Digest" July 2.

OMAHA EXHIBITION.—"West. Elec.," July 23.—A short, illustrated description of the electric service plant at this exhibition.

Wires, Wiring and Conduits.

MAGNETIC CUT-OUT.—"L'Eclairage Elec.," July 2.—A brief description of the Guillaume magnetic cut-out, which is based on the properties of nickel or steel discovered by him. It consists of a plate of mica on which a wire of steel or nickel is secured in the form of a spiral; above this is a permanent magnet, which attracts this spiral while it is magnetic; the diameter of the wire is so calculated that when the current in it is normal the heat generated is such that it will remain magnetic, but if the current increases the wire gets so hot that it loses its magnetic properties and is no longer attracted by the magnet.

Electro-Physics and Magnetism.

SOURCE OF ROENTGEN RAYS. Swinton. Lond. "Elec. Rev.," July 15; abstracted briefly in Lond. "Elec.," July 15.—A Royal Society paper describing his experiments with a pin-hole camera (illustrated in the former journal) in which the image is seen on a screen through a tube. On directing it toward the anti-cathode he noticed that when the latter intersects the cathode stream at its focus, the dimensions of the active area are independent of the exhaustion, while they increase with the exhaustion in any other case. With an anti-cathode inclined to 45° to the axis of the conical cathode stream, it is found that those portions of the stream which are most normal to the anti-cathode surface are considerably the most efficient in producing X-rays. The fluorescent portions of the tube walls also produce these rays; this fluorescence is not produced by the cathode rays, but by the anode rays from the anti-cathode; there is only a difference of degree in the two kinds of rays.

VELOCITY OF IONS CAUSED BY ROENTGEN RAYS. Zeleny. (Univ. of Minn.), "Phil. Mag.," July.—A long article on the ratio of the velocities of the two ions produced in gases by Röntgen radiation, and on some related phenomena. The object is to show that the positive and negative ions which take part in the conduction of gases exposed to X-rays move with different velocities when exposed in the same electric field; also to determine the relation of these gases in several cases and to consider several phenomena which are consequences of and are affected by the difference in the two values.

CATHODE RAYS. Jaumann. "Wien. Akad. Sitzber.," 106, p. a number of articles. One on cathode rays by Wiedemann and Schmidt, from the "Wied. Ann.," 62, p. 603; another on the relation between the positive light and the obscure cathode region by Wiedemann, from the "Wied. Ann.," 63, p. 242; another on the mutual influence of the different regions of the same cathode, by Wiedemann, from the "Wied. Ann.," 63, p. 246; another on the deflection of cathode rays by Kaufmann and Aschkinass, from the "Wied. Ann.," 62, p. 588; and another on the magnetic deflection of cathode rays by Kaufmann from the "Wied. Ann.," 62, p. 596.

CATHODE RAYS. Jaumann. "Wien. Akad. Sitzber," 106, p. 533; abstracted briefly in "Science Abstracts," June.—He describes more fully the details of his experiments with the interference of electrostatic deflection of these rays.

DEFLECTION OF CATHODE RAYS. Kaufmann. "Wied. Ann.," No. 6; abstracted briefly in the Lond. "Elec.," July 15.—He superposes a magnetic upon an electrostatic deflection and from the resulting deflection he draws important conclusions. The deflection is inversely proportional to the square root of the difference of potential between the anode and the cathode. If along any given length of path a certain potential is maintained, the anode ceases to exert any influence and the deflection is inversely proportional to the square root of the difference of potential between the length in question and the cathode. The deflection obeys the law indicated by the emission theory.

STRUCTURE OF CATHODE LIGHT. Goldstein. "Berlin Akad. Sitzber," 40, p. 905; abstracted briefly in "Science Abstracts," June.—He describes the three distinct kinds of radiation.

BI-POLAR DISCHARGE. Wien. "Wied. Ann.," No. 6; abstracted briefly in the Lond. "Elec.," July 15.—He abolishes the distinction between anode and cathode rays, substituting the expressions "streams of positive and negative particles"; that is, it is claimed, shows a victory of the English view. Both kinds of light contain admixture of particles of the opposite sign, which he shows by an arrangement in which the cathode is put into an out-of-the-way side tube. The anode emits positive particles from its front surface, and the cathode, negative particles; both, if perforated, also emit particles of an opposite sign, though to a lesser extent.

FREE ELECTRICITY IN GEISSLER TUBES. Riecke. "Ann. Phys. Chem.," 63, p. 220; noticed briefly in "Science Abstracts," June.—He calculates the volume and surface density of the charges at various points in the tube.

RECTIFYING ALTERNATING CURRENTS. Janet. "L'Eclairage Elec.," July 2.—A reprint of an Academy paper in which he discusses the following problem: Given a Gramme ring with a commutator and two brushes, and either without magnets or without excitation of the magnets; by means of two slide-ring contacts connected to diametrically opposite points of the winding an alternating current is led through it, the effective value being maintained the same; the ring is revolved synchronously by means of a motor; what will then be the nature of the potential at the two brushes? It is discussed analytically, and the results of some tests are given. He arrives at the conclusion that in the development of the Fourier series of the voltage of one of the Paris stations the coefficient of the principal term will be numerically equal to the effective value of the voltage.

MECHANICAL FORCE ON IRON CARRYING A CURRENT. J. J. Thomson. "Phil. Mag.," July.—A short article on the mechanical forces acting on a piece of iron carrying an electric current; he shows how this force can be calculated, it being the sum of the force due to the currents alone plus the magnetic forces.

ROTATIONS IN UNIFORM ELECTRIC FIELDS. Schweidler. "Wien. Akad. Sitzber.," 100, p. 526; abstracted in "Science Abstracts," June.—A mathematical discussion of the general case, the conductivity of both sphere and surrounding medium being at the outset treated as finite.

PARADOXICAL CONDENSER DISCHARGE. Swyngedauw. "L'Eclairage Elec.," July 9.—A reprint of an Academy note in which he discusses an apparent paradox in the derived discharge from a condenser. Under certain conditions it has been shown that the quantity of electricity which passes through a certain shunt coil is much greater than the discharge from the condenser itself; numerous explanations have been proposed for this apparent paradox; he offers another and simple explanation. Under certain conditions this discharge may be ten times as great as the whole charge in the condenser.

COHERERS. Rovelli. "Elettricita," 17, p. 36; noticed briefly in "Science Abstracts," June.—He uses a coherer made up of iron filings, with two thin wire contacts; a mere touch, or even only blowing on it, will restore the needle to its position.

CONTACT ELECTRICITY. Pellat and Sacerdote. "Jour. de. Physique," 7, p. 24; abstracted at some length in "Science Abstracts," June.—A mathematical article.

CONTACT ELECTRICITY OF METALS. Kelvin. "Phil. Mag.," July.—A very long paper which was read at the Royal Institution May 21, 1897.

CONDUCTIVITY OF ELECTROLYTES. Kohlrausch, Holborn and Diesselhorst. "Wied. Ann.," 64, p. 417; abstracted, with some tables of the values, in the "Zeit. f. Elektrochemie," July 14.—An abstract of the paper recently noticed in the "Digest" in which they reduce the conductivities to a common unit.

CONDUCTIVITY OF NITRIC ACID. Veley and Manley. "Chem. News," 76; abstracted briefly in the "Zeit. f. Elektrochemie," July 14.—They give the results of measurements at different concentrations.

DIELECTRIC CONSTANTS OF LIQUID MIXTURES. Philip. "Zeit. Phys. Chem.," 24, p. 18; abstracted briefly in "Science Abstracts," June.—He measured them with a modified Nernst method.

CONDUCTIVITY OF HOT GASES. McClelland. "Phil. Mag.," July.—A paper describing investigations of the nature of the conductivity, not of the flame itself, but of the gases taken from the flame.

RECENT RESEARCHES WITH THE ELECTRIC ARC.—"Elektrochem. Zeit.," July.—A summary of recent researches with references to the counter-electromotive force, polarization, etc.

ATMOSPHERIC ELECTRICITY.—"Zeit. fuer Elek.," July 3.—An abstract of a paper by Brillouin discussing the origin of at-

mospheric electricity. He comes to the conclusion that atmospheric electricity is produced by the action of ultra violent radiation from the sun on the ice crystals in cirrus clouds.

ELECTRO-PHYSICS. "Science Abstracts," June.—Abstracts of a large number of articles which are of interest to physicists rather than electrical engineers; a number of them will, therefore, not be mentioned here specifically; a number of them are abstracts of articles in foreign languages already noticed in the "Digest."

MAGNETIC SUSCEPTIBILITY OF LIQUID OXYGEN. Fleming and Dewar. Lond. "Elec.," July 15.—The conclusion of the reprint of their Royal Society paper (see "Digest" July 23); it contains detailed tables of the results of their experiments. The susceptibility of balls of silver, bismuth, copper and of glass filled with mercury were measured, as was also that of water; with the aid of these they then measured the susceptibility of liquid oxygen. The mean value of the six sets comprising thirty-six determinations was 324 multiplied by 10 to the minus sixth power; this gives for the permeability 1.0041, which agrees within one part in a thousand with their former determination by a totally different method. He also determined the change in paramagnetic susceptibility of crystallized manganous sulphate, and found that it was increased by cooling, so that its value varies inversely with the absolute temperature and is increased threefold by cooling to the temperature of liquid oxygen; their tests show that this law may be valid over very wide limits and to very low temperatures. They think it possible that for paramagnetic bodies, over very wide limits of density and temperature, the law holds good that the magnetic susceptibility varies directly as the density and inversely as the absolute temperature. In an editorial reference it is said that if this is found to apply generally to paramagnetic bodies it will constitute one of the most important physical laws discovered during the last half century; it is suggested to call it the Fleming and Dewar law: it appears to be true, for certain substances at least, over a temperature sufficiently wide to cover more than one physical state of the substance—that is, for the gaseous and liquid states, for instance.

MAGNETIC SUSCEPTIBILITY OF LIQUIDS. Jaeger and Meyer. "Wien. Akad. Sitzber.," 106, p. 594; abstracted in "Science Abstracts," June.—A description of the apparatus and experiments.

ELECTRIC AND MAGNETIC OSCILLATIONS IN HERTZ WAVES. Waitz. "Ann. Phys. Chem.," 63, p. 234; abstracted briefly in "Science Abstracts," June.—His object was to show that the electric and magnetic waves possess different damping coefficients when passing through the same conductor .

EQUILIBRIUM FIGURES FORMED BY FLOATING MAGNETS. Wood. (Univ. of Wis.) "Phil. Mag.," July; abstracted briefly in the Lond. "Elec.," July 15.—A short article describing his method of showing Mayer's well-known experiment with floating magnets, showing how he overcame some of the difficulties involved. He uses a shallow glass dish partly filled with mercury, above a large, vertical electromagnet, and drops small, clean bicycle balls onto the mercury; these will arrange themselves in the forms shown by Mayer; illustrations of these forms are reproduced.

POWERFUL ELECTROMAGNET.—Lond. "Elec. Rev.," July 15.—An illustrated description, with dimensions, of the one designed by Weiss and referred to in the "Digest" June 11, July 9.

VACUUM TUBES. Ferry. "Phys. Rev.," July.—A description of an investigation to study photometrically the changes produced in the spectra of pure gases when subjected to various conditions of current and pressure in vacuum tubes. He found that the luminosity of the lines at a given pressure is directly proportional to the current strength; with a constant current it increases as the pressure decreases, at first slowly, then more rapidly.

EFFECT OF CATHODE RAYS ON GEMS.—"Sc. Am.," July 30.—A note stating that according to Crookes various gems and minerals glow with a beautiful phosphorescence in the cathode rays of vacuum tubes. It seems that the gems have characteristic colors when subjected to these rays, and in this way they may be tested without injury. (The note is headed X-rays, but it appears that cathode rays are meant.)

HIGH FREQUENCY INDUCTION COIL. Boynton. "Phys. Rev.," July.—A very long article which is a mathematical quantitative study of such a coil; it is a modification and expansion of Oberbeck's mathematical theory of the so-called Tesla coil. He also describes an apparatus with which tests were made, showing good agreement with the calculated values.

HARMONIC ANALYZER. Le Conte. "Phys. Rev.," July.—An illustrated description of an instrument which he has so modified that the range and ease of manipulation is greatly extended.

ORIGIN OF THE AURORA. Stuart-Smith. "Jour. of El'ty," June.—A short article on the recent one by McAdie, published in "Century," October. He criticises the article, and thinks the statement that auroras are from 50 to 70 miles high is too broadly made and is based on too limited observations.

CHANGES PRODUCED BY MAGNETIZATION. Stevens. "Phys. Rev.," July.—A short article describing an application of interference methods to the study of the changes produced in metals by magnetization, more especially below the saturation point; the advantages of this method are pointed out.

Electro-Chemistry and Batteries.

ELECTROLYSIS OF ZINC CHLORIDE. Foerster and Guenther. "Zeit. f. Elektrochemie," July 7.—They describe researches with neutral, acid and basic solutions of chloride of zinc, but the conditions are not given in condensed form. The second part refers to the nature of zinc sponge; it appears that zinc sponge is formed when the nature of the liquid in the immediate neighborhood of the cathode is altered by the decomposition; its formation is prevented if a little free acid is added continually; it is important that this acid electrolyte circulates rapidly over the cathode at not too small a velocity. The conditions for the formation of zinc sponge are very complicated, but are all due to the same original causes. They also found that by the addition of a neutral solution of persulphate of ammonium to a neutral solution of 250 gr. sulphate of zinc to the liter, a good deposit will be obtained with a current density of 1 ampere per sq. dm., and there will be no spongy deposit. When proper care is taken the formation of zinc sponge may be prevented entirely.

ELECTRODEPOSITION OF ZINC. Cowper-Coles. Lond. "Elec.," July 15.—A brief description of some recent investigations concerning the formation of zinc sponge. An analysis of the zinc sponge is given, showing numerous ingredients, and some experiments are described which are intended to throw some light on the subject of the formation of this sponge. The cathode was made of a thin aluminum plate, rotated in a horizontal position, and the solution was circulated; gas was projected beneath the anode; the current density was 15 amperes per sq. ft., and the voltage was 2; the deposit, when no gas was passed, was very spongy; the same was true when oxygen and air were used, but coal gas and carbon di-oxide gave good results, and there was practically no sponge formed; the deposits are illustrated.

ZINC EXTRACTION. Threlfall. "Science Abstracts," June.—An abstract of the article noticed in the "Digest" last year, describing the Ashcroft process used in a plant in New South Wales.

REFINING AND RECOVERY OF TIN. Cowper-Coles. Lond. "Elec. Eng.," July 15.—Brief descriptions of several of the methods which have been proposed.

REFINING LEAD ELECTROLYTICALLY. Cowper-Coles. "Elektrochem. Zeit.," July.—A short article describing briefly several processes which have been proposed.

PELETAN-CLERICI PROCESS. Witter. "Zeit. f. Elektrochemie," July 7.—A brief description of the tests of this apparatus made in Hamburg, where it was tried with thirty-five different ores.

SEPARATION OF METALS.—"Science Abstracts," June.—Brief abstracts of the recent articles by Waller and by Stortenbeker, recently noticed in the "Digest," on the separation of cadmium, zinc, cobalt, antimony, tin and iron.

ELECTROLYTIC PREPARATION OF OXYGEN AND HYDROGEN.—"L'Eclairage Elec.," July 9.—A brief reference to a commercial plant in Brussels. The electrolyte is a solution of soda maintained at a temperature of 40° C.; the voltage is 2.5 and the current 350 amperes; this corresponds to 22,000 watt hours, 1680 cb. m. of oxygen and 3360 cb. m. of hydrogen, per twenty-four hours; the energy required for producing 1 cb. m. of oxygen and 2 cb. m. of hydrogen is therefore 12.2 kw-hours; at a cost of 0.2 cents per kw-hour produced by water power or 1.2 cents when produced by steam, the cost of 1 cb. m. of oxygen and 2 cb. m. of hydrogen will be 2.44, or 15 cents, respectively. The oxygen is 90 per cent. pure and the hydrogen 99 per cent.; as the impurity in the oxygen is almost only hydrogen and vice versa, it is very easy to purify these gases, as they are merely passed through a red-hot tube, after which the water formed by their combination is absorbed.

PRODUCTION OF CHLORATES, BROMATES, ETC. Vaubel. "Chem. Zeit.," 22, p. 331; abstracted briefly in the "Zeit. f. Elektrochemie," July 14.—He describes a new process for the electrolytic production of chlorates, bromates, iodates, and hypochlorites. A cell is divided by means of a diaphragm; the anode chamber contains a saturated solution of potassium or sodium bicarbonate, and the cathode space a saturated solution of alkaline chlorides; if heated to 60 or 70° C., and a current passed, the chlorine carried to the anode will be completely transformed into the chlorate. In the same way bromates, etc., of great purity may be produced.

ELECTROLYSIS OF ALKALINE CHLORIDES. Winteler. "Zeit. f. Elektrochemie," July 7.—The first part of an article giving the results of investigations in the decomposition of chloride of potassium, with special reference to the practical application. The question of carbon electrodes is discussed and he claims that by following certain precautions this material is well adapted. The results of a number of tests are described, but no general conclusions are given.

ELECTROLYSIS OF AQUEOUS SOLUTIONS. Glaser. "Science Abstracts," June.—An abstract of a series of articles noticed some time ago in the "Digest."

ALUMINUM ELECTRODES. Wilson. Lond. "Elec. Eng.," July 15.—The first part of a reprint of a Royal Society paper which deals with the apparent resistance of aluminum to the passage of a current when used as an anode in cells containing alum dissolved in water. A list of references is given to papers which deal with this and allied properties of aluminum. The first part refers

to direct currents, and describes the experiments which he performed. There were two cells with aluminum and carbon electrodes, each having 36 square inches area; an exploring electrode consisting of a platinum wire was inserted midway between the two plates, and the two cells were connected in series, the only difference being that the distance between the plates was twice as great in one than in the other; he used 44 volts. When the negative battery pole was connected to the aluminum and the current was 3.6 amperes the voltage was 4.4 and gas was freely evolved; on reversing the connections the current became zero and the voltage 22. A table shows the potential between the exploring electrode and the plates; it appears that the current on reversal first crossed the zero and finally became zero. In the next test pure water was used, and to one cell was added sulphuric acid, while the other contained potash alum; they were left for forty-seven hours with one-twenty-fourth of an ampere; on breaking the circuit the voltage in the first was 0.38, gradually rising to 2.4, while in the latter cell the potential fell to zero; for a reverse current of the same value the former gave 0.24 and the latter 1.29 volts. The aluminum plate which has been formed in the acid was then washed and placed in an alum solution, and it allowed 0.2 ampere to pass, while the one formed in the alum allowed only 0.083 ampere to pass. No general conclusions are drawn in this first portion.

METALLIC SULPHIDE ELECTRODES. Bernfeld. "Zeit. f. Phys. Chem.," 25, p. 46; abstracted briefly in the Lond. "Elec. Rev.," July 15.—He describes the changes which occur in electrolysis with electrodes of metallic sulphides.

POLARIZATION IN ALCOHOLIC SOLUTIONS. Haschek. "Wien. Akad. Sitzber.," 106, p. 580; abstracted briefly in "Science Abstracts," June.—Results of tests.

ELECTROCHEMICAL BEHAVIOR OF CHROMIUM. Hittorf. Lond. "Elec.," July 15.—An abstract of the paper noticed in the "Digest" July 30.

ACCUMULATOR.—"Elektrochem. Zeit.," July.—A short description of an accumulator made by a Berlin company and called the G. m. b. H. The object was to find a binding material which will make the mass more solid and less destructible; it was found that organic hydrocarbons used as a binding material for the lead oxide and answer all requirements (no further reference to any particular hydrocarbons is given). The accumulators thus constructed are said to be exceedingly strong, of light weight and to have a very great capacity; according to the tests made by the Reichsanstalt the capacity is 74.7 ampere hours per kg of positive electrode; according to the company's own measurements it was 20 ampere hours per 1 kg of weight of complete cell, under conditions of the most favorable efficiency (meaning, probably, at a very slow discharge). The electrodes consist of a frame like that for a slate, and made of hard metal. (No figures are given concerning the life of such plates nor the rate of discharge which they will stand.)

STRENGTH OF ACID IN ACCUMULATORS. Dolezalek. "Science Abstracts," June.—A brief abstract of the articles noticed in the "Digest" on the variation of the E. M. F. and efficiency of lead accumulators with the strength of acid. He considers that Liebenow's theory is the only one which can be consistently maintained; the differences in the E. M. F. with different concentrations are shown to be in excellent accordance with the calculated values; the low watt efficiency is believed to be due to the fact that the action is only partially reversible; it is calculated that the accumulator should work with maximum efficiency with acid of maximum conductivity—that is, with 30.4 per cent. of sulphuric acid; experimental results agree with this.

ACCUMULATOR CONSTRUCTION. FitzGerald. Lond. "Elec. Eng.," July 15.—In this continuation of his long serial he continues the discussion of the weight of the plates.

PERIODIC TESTS OF ACCUMULATORS.—Lond. "Elec. Eng.," July 15.—Replies to a request to state what periodic test should be made, what records should be kept, and how the cells should be treated.

RELATION OF CHEMISTRY TO ELECTRICAL ENGINEERING.—Lond. "Elec. Rev.," July 15.—A short editorial article showing the close relationship between these two sciences. It is thought that the principal problem for the chemist is not to find a cheap source or energy, but to develop and perfect the electrolytic apparatus in which the energy is utilized. A paper by Burgess in the "Wisconsin Engineer," Vol. 2, No. 2, is highly recommended.

CONGRESS OF APPLIED CHEMISTRY.—"Zeit. fuer Elek.," July 10.—The programme of the third International Congress for Applied Chemistry, which is to meet in Vienna from July 28 to August 2.

Units, Measurements and Instruments.

MEASURING QUANTITY OF ELECTRICITY DIRECTLY; A NEW METER. Blondlot. "L'Eclairage Elec.," July 2, and "L'Elec.," July 16.—A reprint of a short Academy paper describing an interesting method of measuring quantity of electricity directly in electro-magnetic units and an application of this to a meter. A long, hollow, coil is placed horizontally; at its centre there is a second coil of several turns of wire, having the form of a ring; this is suspended in a vertical plane, so that it can turn freely around its vertical diameter; the same current flows through both of them. The earth's magnetism having first been compensated, the inner coil, by the action of the current, takes a position of equilibrium in which its windings are parallel to those of the fixed coil. If the movable coil is deflected slightly it will make isochronous oscillations; he proves that, whatever be the intensity of the current and the frequency of the oscillations, the quantity of electricity which passes through a section of the circuit during one oscillation is always the same. He then shows how this quantity may be calculated so as to give the reading directly in electromagnetic units. To apply this principle to a meter it is only necessary to produce and count the oscillations; during each oscillation the quantity of electricity is the same, whatever be the current strength, and to obtain the total quantity during a certain time it is only necessary to multiply this quantity by the number of oscillations during that time; this is theoretically exact, but only if the variations in the intensity of the current take place only at the moments when the movable coil passes through its position of equilibrium, but this error is in general absolutely negligible in practice. In the suggested application the movable coil has a lever which projects beyond the fixed coil, and in its middle position it makes contact with a spring, closing the circuit of a magnet, which attracts that spring, so as to push the pointer in the opposite direction; thus at the end of every half oscillation the lever and its coil receive a fresh impulse; by means of a ratchet the electromagnet moves a recording wheel one tooth for each oscillation, thus recording the number of oscillations; the force imparted to the coil by the magnet has no influence on the duration of the oscillation, provided the oscillation is small. A number of models have been constructed, as well as a commercial form of meter, but the latter is not described. Instead of calculating the constant, the meter is calibrated empirically; a number of trials have shown that the ratio of the current intensity to the number of oscillations in a given time is independent of the current (that is, the current is proportional to the number of oscillations); for a meter registering up to 11 amperes it was only below 0.5 amperes that this proportion began to vary appreciably. Such a meter is applicable to alternating current as well as continuous; it will start even with a current of less than 0.1 amperes, owing to a device not described.

CALIBRATION OF LOW RESISTANCES. Fisher. Lond. "Elec.," July 15.—A discussion of the Mueller and Wallau method and of Callendar's comments (see "Digest," last week). He claims that when great accuracy is required the difficulty is due to the calibration of the slide wire proposed by Callendar; he claims that an accuracy such as is claimed by the latter in the calibration of this wire is very rare. He makes frequent references to the Crompton potentiometer, which he praises very highly; very low resistances cannot be measured with the potentiometer by means of the Clark cell, except with an abnormally large current, but with the Crompton instrument this cell is not used in such comparisons, the standard being the difference of potential at the terminals of a known or standard resistance in series with the one to be measured and a source of constant current. For high-class work no bridge method is comparable with that of the potentiometer.

MEASURING THE RESISTANCES OF ELECTROLYTES. McIlhiney. "Industries and Iron," 24, p. 245; noticed briefly in "Science Abstracts," June.—He describes a new method, which is a slight improvement of the ordinary potentiometer method. The electrolyte is connected in series with a known resistance and the potential difference at the terminals of the latter is observed; the electrolyte is then replaced by a second known resistance, the first being still in circuit; the potential difference is again observed at the same point as before; at the terminals of the electrolyte the current is alternated by a rotary commutator, but the current through the known coil is always direct. The method is said to be probably of use for approximate rapid measurements.

MEASURING MAGNETIC INDUCTION. Orlich. "Zeit. Instrumentenkunde," 18, p. 39; noticed briefly in "Science Abstracts," June.—A description of the experiments of the Reichsanstalt with the Koepsel instrument (see ELECTRICAL WORLD, last week, p. 114); the results show that for soft iron this instrument gives exceedingly accurate values, but somewhat less so for steel, although sufficient for practical purposes.

PERMANENCE OF MANGANIN RESISTANCES. Jaeger and Lindeck. "Zeit. f. Instrumentenkunde," 18, p. 97; abstracted in "Science Abstracts," June.—A description of the tests at the Reichsanstalt. They found that manganin copies of the standard ohm may even have greater constancy than the mercury standards; "patent nickel" alloy appears to have the same order of constancy as manganin (for this alloy see Lond. "Elec. Rev.," 42. p. 536, et seq.); mercury resistances diminish with time, and in the course of five or six years the diminution may amount to about a ten-thousandth of the nominal value; with manganin the tendency is for the resistance to increase; the greatest change in a 1-ohm coil is 55 millionths of the total resistance in five years. The second part of their investigations relates to tests of the constancy of manganin resistances of fractional parts of an ohm; the change was a little more than 0.01 per cent. in 2.5 years. In other tests of manganin coils of high resistances they found a very decided variation with time.

METALLIC RESISTANCES. Scott. Lond. "Elec. Rev.," July 15.—The first part of an article including several large tables which, if reliable, appear to be of value; they are for designing starting and regulating resistances. The first table, which has been compiled from many sources, and thus gives the average values, is for German silver, platinoid, iron and manganin. It gives the yards per pound and the pounds per yard, as common to all the materials, which is approximately correct; the watts per yard for a rise of

50° C. is also given as common for all four; the normal current in an iron frame represents approximately the safe current which it will carry continuously when wound as a vertical spiral with good ventilation; the diameters of the mandrils are given; the wire is usually wound as a closed coil, and then pulled out to about double its length, or somewhat more for the smaller wires, which lack stiffness; another column gives the current which these wire coils will carry for one minute, and these appear to be exactly double the other currents; the resistances and their reciprocals, as also those per 100 turns, are given. No 24 and No. 8 B. W. G. are generally the smallest and largest wires used. Another table gives the particulars for Hadfield's "resista," which is a manganese steel alloy having a resistance of 75.5 microhms per cb. cm.

ELECTROCHEMICAL ACTINOMETER. Rigollot. "Jour. de Physique," 6, page 520; abstracted briefly in the "Zeit. f. Elektrochemie," July 14.—This apparatus is said to be well suited for photometric measurements, and depends on the fact that a difference of potential will arise between two metallic plates in the same solution, on one of which the light falls, while the other is in darkness; heretofore only silver and silver salts were used; in the present article he describes investigations with other metals; a short table of the results is given in the abstract.

PYROMETRY. Stansfield. "Phil. Mag.," July.—A reprint in full of the Physical Society paper noticed in the "Digest" April 23, in which he describes some improvements of the Roberts-Austin recording pyrometer and includes some notes on thermo-electric pyrometry; the modifications were made in order to obtain large scale temperature records with a high degree of accuracy.

THERMOPILES. Rubens. "Zeit. Instrumentenkunde," 18, p. 65; abstracted briefly in "Science Abstracts," June.—The objections to the Melloni thermopile are sluggishness and the doubtful zero; by reducing the thermal capacity of the parts he succeeded in making an instrument of extreme sensitiveness; he uses iron and constantan in the form of fine wires, and is able to measure with certainty of one-millionth of 1° C.

DIRECT-READING PHASE METER. Bruger. "Elek. Zeit.," July 14.—The complete paper, of which an abstract was noticed in the "Digest" July 16; illustrations of the apparatus are given.

REGISTRATION OF ATMOSPHERIC DISCHARGES. Ducretet. "L'Elec.," July 16.—A short Academy note in which he mentions the registering of atmospheric discharges by means of the receiver for a wireless telegraphy apparatus. In about one hour during which there was a storm this receiver recorded automatically 311 intermittent atmospheric discharges; these were registered before the appearance of the lightning or the noise of the thunder.

STANDARDS OF LIGHT. Laporte. "Bul. Soc. Int. des Elec.," May.—The complete, long paper, an abstract of which was noticed in the "Digest" June 4.

CLARK CELLS ON CLOSED CIRCUIT. Wulf. "Wien. Akad. Sitzber.," 106, p. 526; noticed, with the results, in "Science Abstracts," June.—He made measurements on small cells of the standard pattern.

BALLISTIC GALVANOMETRY. Barus. "Phys. Rev.," July.—A description of a proposed new method of reading ballistic galvanometer deflections which he thinks offers some advantages. The needle is provided with stops, so that it can be deflected in only one direction, and it is held against these stops by the torque of a twisted fibre; when the current passes, the deflection will be less in proportion as the counter torsion is greater; the charge may then be expressed in terms of the observed twist, provided the deflection is a fixed value in all the experiments; the needle practically does not leave the plans of the coils. The theory of the arrangement is discussed at considerable length.

TEN-CANDLE PENTANE STANDARD.—"Prog. Age," July 15.—A short description, without any illustration, of Harcourt's standard.

SPEED INDICATOR. Browne. "El'ty," July 27.—A brief, illustrated description of an instrument consisting of a small, permanent magnet dynamo, the armature of which is made to revolve by being connected with a flexible shaft to the shaft whose speed is to be indicated. The voltage of this dynamo will be directly proportional to the speed.

PREPAYMENT METERS.—"Sc. Am. Sup.," July 23.—A reprint of the illustrated article noticed in the "Digest" July 2.

Telegraphy, Telephony and Signals.

SIGNALING WITHOUT CONNECTING WIRES. Edser. Lond. "Elec. Eng.," July 15.—The conclusion of his long serial (see "Digest," July 23). He discusses the production and utilization of electrical oscillations of very short wave length, Lodge's syntonic system and coherers.

COMMUNICATION ON TRAINS.—Lond. "Elec. Eng.," July 15.—A reprint of the report of the Board of Trade Committee to consider means of communication between the passengers and the operators of trains; it is also discussed editorially in the Lond. "Elec. Rev.," July 15. They condemn as insufficient the present method of a cord outside of the car, but think that several electrical methods are sufficiently efficient; they recommend the use of improved methods, and give certain conditions which they should fulfill.

TELEPHONES. Preece. Lond. "Elec. Eng.," July 15.—An abstract of his recent evidence before a committee. While in certain German cities the telephone is developed to a phenomenal extent, and far more so than in England, yet, taking the country as a whole, England is not in as bad a position as has been represented; the telephone is in the hands of the post office in Germany, and is unincumbered by any restrictions. He condemned the automatic exchange, but not for mechanical reasons.

ELECTRIC CLOCK.—"Elek. Zeit.," July 14.—A brief, illustrated description of the Kessel clock. The pivoted armature consists of two permanent magnets shaped something like a star with alternate N. and S. poles; these are opposite four radial electromagnets, through which a reverse current is passed once every minute; the armature will thus be turned each time through one-quarter of a revolution and held there; this armature operates the hands of the clock.

HAWAIIAN CABLE.—"Eng. News," July 21.—A note stating that the contract for this cable was signed July 2 on the part of the Hawaiian Government. It gives the Pacific Cable Company, of New York, an exclusive right for cables between those islands, United States, Japan and China, including also the Ladrones and the Philippine islands, subject to authorization by Congress. It is to go from San Francisco, the distance being 2097 miles; the total distance from San Francisco to Japan will be 6500 miles, or including 16 per cent. slack, about 7500 miles; the estimated cost of the cable and repair ship is $7,500,000. Official messages of the United States are to be transmitted free of cost forever.

SHIP TELEPHONE.—"Sc. Am. Sup.," July 16.—In an illustrated description of the Spanish battleship Pelayo there is included a description of the telephone system, with illustrations of the apparatus and the diagram of connections.

SWITCHBOARD FOR TOLL LINES. Clausen. "West. Elec.," July 23.—A short, illustrated description of a uniform method of interconnecting toll line circuits.

TRANSMITTING PICTURES.—"Sc. Am. Sup.," July 30.—A few further illustrations, accompanied by a brief description, of the Szczepanik invention, which was noticed in the "Digest" July 23.

Miscellaneous.

VACUUM DRYING CHAMBERS. Lond. "Elec." and "Elec. Eng.," July 15.—A short, illustrated description, the illustrations being better in the former journal, of some chambers for drying cables and other electrical apparatus; by using a vacuum in addition to heat the drying is effected in the smallest possible time and with the greatest thoroughness; the temperature need not be nearly as high as with the old method.

CARBONS. Jehl. Lond. "Elec.," July 15.—In this continuation of his long, illustrated serial he describes various presses and press pumps used in carbon factories in Germany.

MECHANICAL APPLICATIONS OF ELECTRICITY. Richard. "L'Eclairage Elec.," July 9.—Brief, well-illustrated descriptions of various applications taken from patent specifications.

ELECTRICITY AND THE LAW. Haas. "Elek. Zeit.," July 7.—A reprint of a paper read at the recent meeting of the Union of German Electrical Engineers. He shows that the electrical industry does not enjoy the protection of the law which is extended to other industries, as the stealing of electrical energy is not punishable and only on technical grounds. He recommends that the society take action for obtaining proper legal rights.

RESISTANCE OF THE HUMAN BODY. Dubois. "L'Eclairage Elec.," July 9.—A reprint of an Academy note in which he describes the determination of the relative value of the period during which the resistance is variable, under the different conditions of resistance, self-induction and capacity and circuit.

EXHIBITION.—"L'Eclairage Elec.," July 2.—Brief descriptions of some of the electrical exhibits at the Conservatoire des Arts et Metiers, including Guillaume's magnetic short circuit, described elsewhere, Richard's energy meter, which reads directly and at the same time registers, and some measuring instruments by Demichel, one of which is a double rate meter.

PRIZES.—"Elek. Zeit.," July 14.—A list of the prizes, as far as they concern electrical subjects, offered by the Industrial Society of Muelhausen.

CANADIAN ELECTRICAL ASSOCIATION.—"Can. Elec. News," July.—A very full record of the proceedings of this meeting, with reprints of the papers and the discussions. Some of these have already been noticed in the "Electrical World."

CENTRAL STATION CURRENTS IN ELECTROTHERAPEUTICS. Jones. "Jour. of El'ty," June.—A short article on the Hertzstein apparatus.

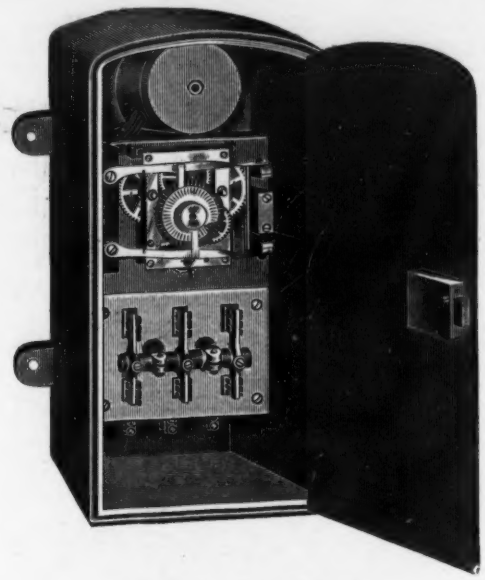
Automatic Cut-In and Cut-Out Electric Time Switch.

The demand for an absolutely reliable cut-in and cut-out electric time switch has reached such proportions that the Cleveland Electric Company, Cleveland, Ohio, has designed and perfected a switch of this kind for the purpose of automatically closing and opening electric circuits controlling any given number of lights or quantity of currents on power circuits, from one to two hundred amperes.

The time switch consists of two or three-pole double-break knife-blade

switch, operated by an electro magnet in conjunction with a lever and spring, whereby an instantaneous break or opening and closing of the circuit is obtained, the operating current being controlled by an eight-day clock movement.

Two discs or dials are mounted on the hour stem of the clock movement, and are held in position by means of an adjustable thumb nut. These discs or dials are divided into twenty-four sections, representing the hours of a solar day. Each dial has a zero point notched in the periphery, which allows a lever or contact arm to drop at the zero point. When time of switching on arrives (small dial) this contact arm closes a circuit through one of the magnet coils, which, acting on the lever and spring referred to, closes the knife switch, thereby completing circuit. This action of the magnet in turn opens the knife switch when the time arrives (large dial) for the cutting out of the lights or supply of current to the circuit. The current that is utilized in operating the magnets is controlled by circuit breakers, which prevent a constant flow of



AUTOMATIC TIME SWITCH.

current passing through the magnet coils, therefore no current is consumed in throwing the switch except when the time arrives for switching on and off, and then only for a period of a second of time. This makes the action of the switch positive and prevents any injury to the magnets from an excessive flow of current.

This switch will automatically switch on or off a given number of lights or quantity of current at a predetermined time, and will perform its work in a satisfactory manner, owing to the reliability of the switch in its electrical and mechanical construction and the accuracy of time when both of the above actions take place. It will effect an immense saving that will accrue to the consumer of current on the meter basis, and likewise to the producer of illuminating companies in reduction of labor necessary for switching, aside from the saving made in the consumption of current gained in having all street arc light switched on at the same time. The switch operates and performs its work successfully on direct current two or three wire systems.

Improved Electric Heaters.

In constructing an electric heater the object sought is to transfer the heat generated in the device to the surrounding air. It is evident, therefore, that the greater the surface of the heating device exposed to the air the more readily will the heat be dissipated.

Some improved forms of heaters have been brought out by the Gold Street Car Heating Company, of New York. The resistance coils are supported in such a way that the support itself, while holding the wire firmly in place and not permitting vibration, offers the least possible amount of friction of the

FIG. 1.

flow of air through the heater. The support consists of a one-fourth inch steel rod, which is thoroughly covered with an insulating enamel burned on the rod at a temperature of over 2000 degrees. This enamel is said to be an excellent non-conductor, and is not affected by any heat to which it will have to be subjected in practice. The rod is in wave form, as shown in Fig. 1, and the resistance coil when slipped onto it is supported in the manner indicated in the illustration.

The composition of the resistance wire itself has been the subject of special attention, and is said to combine high resistance with non-corrosive qualities. The wire has been tried under all conditions, and has never failed. The resistance coil is wound on an open pitch, so that when it is placed on the rod it is in its natural condition and not subjected to any strain whatever. By this form of construction a large amount of wire can be placed in a small compass without resorting to the use of a bulky and solid core, at the same time an even temperature on the wire itself is secured and free circulation of air through the coil obtained. It is stated that tests of these improved coils show that they have at least 30 per cent. greater efficiency than other heaters of this class. The company is using this form of construction in all electric heaters which it now manufactures.

An improved form of electric car heater sets into the panel under the seat, the front of the heater being flush with the panel. It is lined with asbestos, and is provided with an air space at the top. The coils are so arranged that the upper sets are in multiple and the lower set in single series. Usually six of

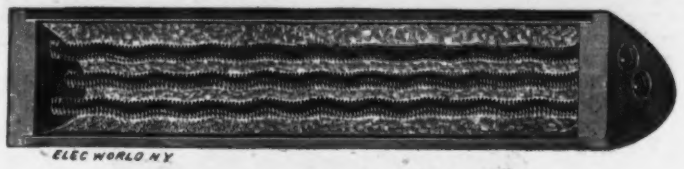


FIG. 2.

these heaters are applied to a 24-foot car, and the heat graduated to three different degrees by turning the handle of a switch to any one of the three different points. Fig. 2 shows an interior view of a small-size panel heater. The coil used in this heater and the support are the same as those used in the three-degree heater.

The Gold standard electric heater is shown in Fig. 3. It consists of three improved resistance coils and supports placed in series. These rest on porcelain plugs or caps at either end, and are incased in a cylindrical perforated sheet-iron casing. The heater is 3 inches in diameter and 20 inches long, and is commended for its simple construction and efficiency. It is particularly adapted for cross-seat cars. It is claimed that perfect uniformity of distribution of the heat can always be secured by the use of these heaters, for the reason that they can be placed about the car in such a way that this condition can always be maintained. The heaters are light in weight, and their durability is guaranteed.

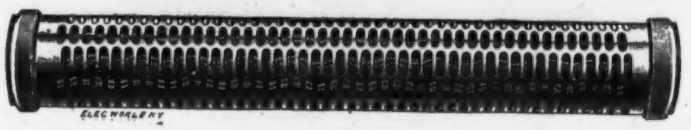


FIG. 3.

The company manufactures besides those above enumerated electric heaters of different styles and sizes for dwellings, office buildings, etc. The portable heaters are fitted with a three-point switch, making it possible to give three different degrees of temperature. They are provided with a flexible cord with plug attached so that it may be connected to an ordinary lamp socket. It is compact, efficient and ornamental, and is of small weight, so that it can be easily moved about from one room to another.

Narrow-Gauge Railway Motor.

The operation of a narrow gauge road demands a railway motor occupying a more restricted space than the motor built for standard gauge roads, while giving the same power. The General Electric Company has manufactured narrow gauge motors for some time past, and many are in actual service giving, it is stated, a high degree of satisfaction. One type of narrow gauge motor now built is the GE-58, which resembles in outer appearance the standard gauge motor, and has an output of 37 horse-power, based on the standard General Electric rating, i. e., a maximum rise of 75° centigrade in the temperature of the windings after a run of one hour at rated load, the temperature of the surrounding air not exceeding 25° C. This motor is built for comparatively heavy service in which the GE-52 motor would be too light, and is especially desirable in cases of combined city and interurban service, with moderately high speeds and heavy traffic. While designed for a minimum gauge of one metre (39¼ inches), the GE-58 may be used with wider gauge roads.

The magnet frame is made of soft steel of high magnetic permeability, cast in two bowl-shaped halves. The frame is divided in a horizontal plane, and the two parts when bolted together completely inclose and protect the armature, commutator brush holders and field coils. Extension pieces are cast on the top at each end, and extend over and partly inclose the car axle. To the under side of these extension pieces are bolted the axle bearing caps bored out to support and inclose the axle linings. The armature supports are made by bolting the bearing caps to the under side of the top frame at each end and boring them to receive the linings. The bottom frame is secured to the top frame by bolts so hinged that when the rear bolts are removed the lower frame will swing down, exposing the armature and field coils for inspection and cleaning. In this position the bottom field coils may be easily taken out, while by removing the armature caps and the bottom half of the gear case the armature and top field coils may be easily removed.

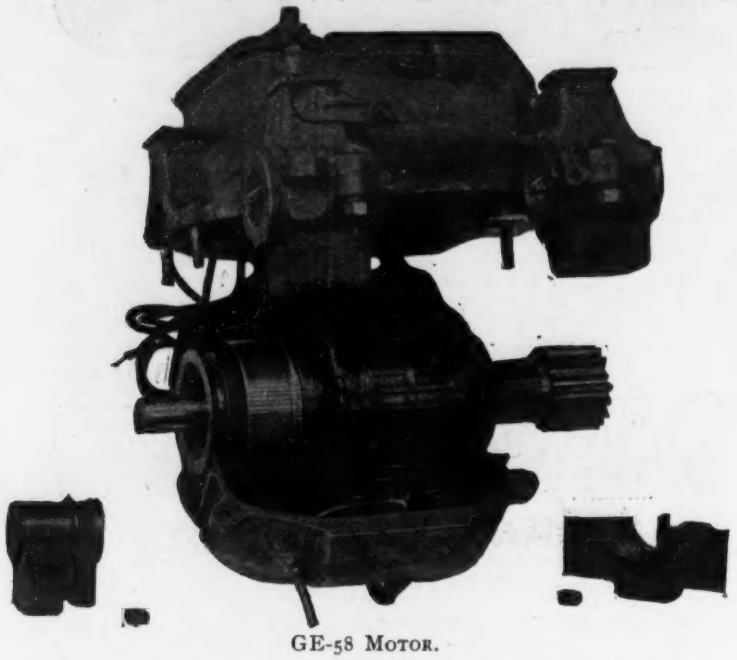
A large opening is provided in the top frame just over the commutator, through which the commutator, brush holders and brushes can be inspected and worn-out brushes replaced. Through the same opening it is possible to remove the brush-holder yoke and brush-holder bodies.

The armature bearing linings are made of machined cast iron, with three-sixteenth-inch Babbitt metal swaged hard and bored to the proper size to fit the shaft. The bearing of the commutator end is 2⅝x6 5-16 inches, and on the pinion end 3x7⅞ inches. The axle bearing linings are similar to the armature bearing linings, and are 8 inches in length and of the required diameter to fit the car axle. The upper supports for these linings are cast with the upper frame; the lower supports are caps bolted to the upper support. All bearings on the motor are provided with grease boxes and oil cellars of sufficient capacity for thorough lubrication.

The motor has four field coils, two in each frame, placed at an angle of 45° from the split, and held in place by pressed steel flanges, or spool holders, clamped by projections on the laminated pole pieces. The pole pieces are held in place by through bolts, with nuts on the outside of the frame, the coils being placed in position when the pole pieces are bolted to the frame. The field coils are wound with round wire insulated with asbestos, and are substantially

insulated over all with wrappings of varnished cloth and tape. The insulation between field coils and motor frame is tested by 5000 volts alternating sufficient to thoroughly prove the quality of the insulation.

The armature is of the well-known iron-clad type, and is 14½ inches in diameter, with a spread of 6½ inches. There are thirty-three slots, and each slot contains three coils, collected together and insulated so as to form one triple coil. Hence there are thirty-three triple coils connected with ninety-nine commutator bars. A small number of coils is of special advantage when an armature has to be repaired, and the method of forming the coils into groups of three admits of substantial insulation of high quality. The insulation of the coils consists of specially prepared tape and cloth, which has high



GE-58 Motor.

insulating qualities, and is impervious to moisture. When the coils are in place on the armature core they will withstand without injury a high potential test of 2500 volts between the windings and the core.

The commutator is 10 inches in diameter. Its segments are 4⅜ inches long with a wearing depth of 1 inch, and are insulated from the shell by cone clamping insulations of the best quality of pressed mica. The completed commutator is tested by 5000 volts between segments and shell, and 500 volts between adjacent segments.

The brush holders of cast brass are constructed to receive two carbon brushes per holder. The brushes are 1⅜x2¼x½ inches.

GE-58 motors are adapted to nose, yoke or side-bar suspension. When the motor is mounted on 33-inch wheels the clearance between the bottom of the motor frame and the top of the rails is 4¼ inches; the clearance between the bottom of the gear case and the top of the track is 4¼ inches. The motor without gear or gear case weighs 1865 pounds, and complete, with both gear and gear case, weighs 2150 pounds.

Magneto Bell of New Design.

The accompanying illustrations show a magneto bell of new design, manufactured by the Williams Electric Company, Cleveland, Ohio. The generator

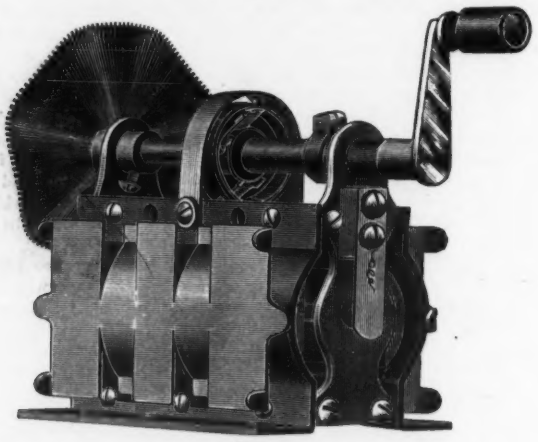


Fig. 2.

(Fig. 1) has three powerful horseshoe magnets three-eighths of an inch in thickness and 1¼ inches in width. These magnets are held close together onto the pole pieces by brass bolts, there being practically no space between the central and outer magnets. The uniform distribution of the magnetism around the curved surfaces of the pole pieces is accomplished by means of contact plates shown in Fig. 2. Each contact plate has two ears turned inwardly to hold it in position on the pole piece, and has also four ears turned outwardly to hold the permanent magnets rigidly in position. Three sections of the contact plate are left flat or straight, so as to make a good contact surface on the permanent magnets, and two portions are formed so as to make curves coincident with the outside curvature of the pole pieces. By this arrangement a better contact is obtained than in the old way, and at the same time a greater effective length of permanent magnetism. The end plates, which hold the shaft bearings, are punched from heavy brass, and have riveted into them long brass bearings, which insure a quietly running machine for a long period of time. These plates are practically self-centring. This feature is a very important one in making repairs on the generator. The machine can be taken apart and reassembled without the use of any special tools or appliances and with but little trouble. It is equipped with a reliable clutch form of automatic shunt or

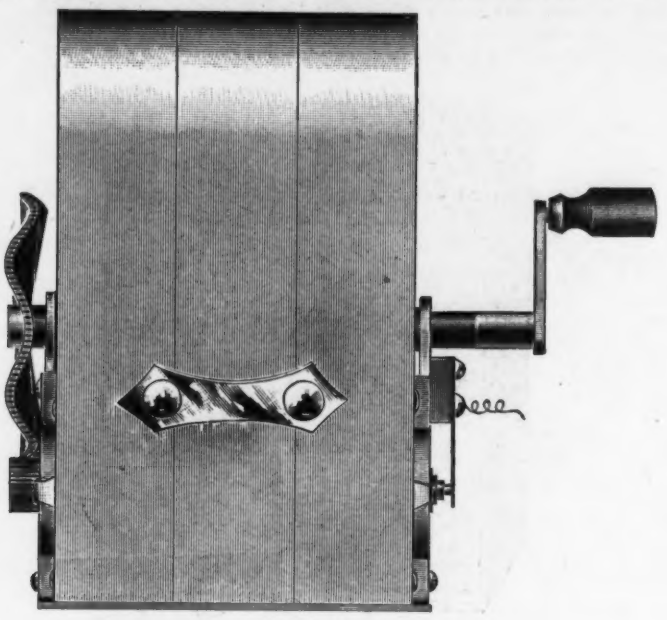


Fig. 1.

cut-out which, by reason of its simplicity of construction, is not liable to get out of order.

The driving gear, it is claimed, embodies an entirely new principle in gearing. It is placed on the left-hand side of the generator, so as to avoid unequal wear on the gear bearings. With this construction the proper centre distances between the gear shafts is maintained indefinitely.

The gear is made from a brass punching, radially corrugated for the purpose of distributing its tooth surface over the surface of the pinion in a uniform manner. This gear, it is stated, will not only last longer, but will run quieter during its life than will a wide-face cast-cut gear.

The pinion is attached to the armature shaft by means of a key and machine screw, and can be taken off and replaced with great ease. This little feature is of great convenience when repairs are necessary.

The ringer, Fig. 3, is a new departure in this line. It has but a single core, which is parallel with the vibrating armature. The core heads or end pieces are formed up of Swedish iron, and are swaged onto the core under an enormous pressure, which practically welds them to the core, thus forming a very perfect magnetic joint. The hammer strikes a very hard and stiff blow to the gongs, and acts in unison with the generator pulsations, whatever their frequency. This is a valuable feature in toll-line signaling, where sharp, clear and distinct tones are almost an absolute necessity.

The magneto complete is provided with a long lever gravity switch hook, with Craig silver contact pieces firmly attached to a hard-rubber block, the block and hook being mounted in such a way as to make the switch hook entirely self-contained.

The receiver-cord binding posts are unique in design. They form a lock for the cord tips, and hold like a vise, preventing the tips from working loose and dropping out.

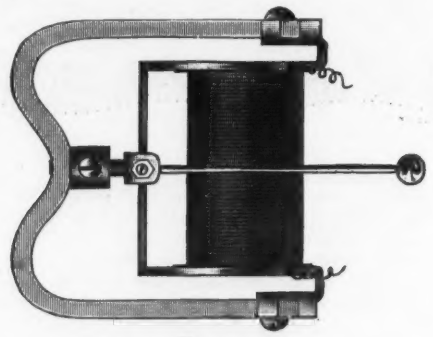


Fig. 3.

These machines are wound to ring through any resistance, from the standard of 10,000 ohms up to 150,000 ohms.

The Williams Electric Company states that its object in designing this machine was to construct a magneto bell that would last indefinitely and require the fewest repairs at the least possible cost in time and money, and great care was bestowed in producing the finished machine. The company is designing an efficient bridging bell, which it claims will not infringe any existing patent. It will soon be ready for the market.

NEWS OF THE WEEK

Financial Intelligence.

THE ERIE TELEGRAPH & TELEPHONE COMPANY has declared dividend No. 59 of 1 per cent., payable August 15.

Special Correspondence.

NEW YORK NOTE.

Office of THE ELECTRICAL WORLD,
9 Murray St., NEW YORK, August 1, 1898.

THE WESTERN UNION TELEGRAPH COMPANY'S central cable office has been ordered by the West India & Panama Telegraph Company, which operates the submarine cables between Jamaica and Porto Rico, to decline messages for all stations in Porto Rico except San Juan.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., July 30, 1898.

THE BUFFALO RAILWAY COMPANY is burying its feed wires on the Niagara street line in order to be in advance of the new pavement. This appears to be done voluntarily, and is a curious commentary on the attitude of electrical companies a few years ago, when it was maintained that the high potential currents could never be put under ground.

IT IS ANNOUNCED that the Lockport line of trolley road that is to include the Erie Railroad line between Tonawanda and Lockport. will be opened within ten days, though the exact date is not yet set. It is probable that part of the Buffalo City Company's line will have to be used to get across the steam lines in the north part of the city.

THE BUFFALO VALLEY trolley line has obtained its franchise from the Railroad Commission, and will now proceed to secure the right of way, most of which can be had for the asking. The undertaking involves considerable engineering work, as the road will have to cross Buffalo Creek twelve times, and there will need to be two other bridges in the 27 miles of track. This is a rich valley, through which the stream wanders from side to side in a way that makes numerous bridges necessary.

PITTSBURG NOTE.

PITTSBURG, Pa., July 30, 1898.

INSPECTING THE WESTINGHOUSE WORKS.—On July 30 on the invitation of the Westinghouse Electric Manufacturing Company and the Westinghouse Machine Company, 500 prominent business men and engineers of Pittsburg inspected the works of these companies at East Pittsburg. These two concerns will ship some large engines and generators to London. Three of the engines are of 2000 horse-power, and will be direct-coupled to Westinghouse generators, each of 2000 horse-power. These engines and generators are for the Metropolitan Electric Supply Corporation, London.

ST. LOUIS NOTES.

ST. LOUIS, Mo., July 29. 1898.

THE STATE SUPREME COURT by mandamus has ordered the Board of Public Improvements to grant the National Subway Company the right to connect its conduits on Olive Street with the buildings along the route.

THE COLLINSVILLE ELECTRIC LINE.—The promoters of the new electric line between East St. Louis and Collinsville have decided to push the work. It will probably be named the Monks Mound route, as it will run within a few yards of the historic Monks' or Cahokea Mound.

THE CITY COUNSELOR has submitted to the Board of Public Improvements his opinion on the application of the Bell Telephone Company for permission to erect poles in certain alleys in the subway district. He says the board is the legal judge of the necessity for the erection of poles, and that unless the board is convinced there is no necessity it has no right to refuse the applications for permits as made by the company.

THE FRANCHISE measure allowing the Lindell Railway to merge into one grant all the franchises it holds at present has been favorably reported to the City Council. It provides for connecting loops and lines between the various divisions of the road. It also provides that transfers shall be given over all the different divisions at eighteen different points; that the road shall pay to the city, two years after the ordinance is approved, $28,000 for six years, $32,000 for the next eight years, 3 per cent. of gross earnings for the next ten years, 3½ per cent. for the next nine years and 4 per cent. for the last nine years. In exchange for this the city extends the franchise for all the roads till 1942, and allows the construction of numerous loops and connecting lines.

MEXICO NOTES.

MONTEREY, Mexico, July 25, 1898.

IT IS REPORTED here that an American syndicate is arranging to build an electric street railway system in Tampico.

THE BUILDING occupied by the Federal Telegraph Company's general offices in the city of Mexico has just been equipped with a technical department in which the most modern electrical appliances have been installed.

A SYNDICATE of Mexican capitalists of the city of Mexico has petitioned the Mexican Government for a concession to establish a large street car manufactory in that city. Recently mechanics in that city constructed two cars for the Federal District Street Railway Company of the city of Mexico and their work was so well done as to call forth much favorable comment from high government officials.

ADVICES have reached here of the opening of a tramway, which runs for a distance of about 45 miles through the heavy mountainous section between San Antonio, a station on the Mexican Southern Railroad, to the town of Chilchotla, in the district of Tiotitlan, State of Oaxaca. It is reported that the road is to be equipped with electric traction in the near future. The road passes through a rich coffee section.

PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., July 17, 1898.

THE EAGLE & SHAWMUT MINING COMPANY, of Jacksonville, Tuolumne County, Cal., is seriously considering a proposition to install an electric generating and transmission plant, to be operated by water power.

THE OLYMPIA LIGHT & POWER COMPANY, of Olympia, Wash., recently lost its car barn and rolling stock by a night fire. The loss amounted to about $18,000, and the cause of the fire is unknown. The cars will be replaced as soon as possible.

THE LOS ANGELES LIGHTING COMPANY'S bid was finally accepted by the city of Los Angeles. Each street lamp will cost $6.50 per month. The masts will be retained and 180 lamps will be added. The reduced rate will save the city about $20,000 a year.

THE FORT WAYNE ELECTRIC CORPORATION has just shipped from its San Francisco agency a 250-light generator, to operate focusing lamps in hydraulic mining in Bolivia. The mines are owned by the Yani Development Syndicate. The plant will be operated by a Tuthill water wheel, manufactured at the Oakland Iron Works. The method of working is similar to that of the great North Bloomfield mine.

THE TRANSPORTS of the four fleets which have left San Francisco for the Philippine Islands have been more or less thoroughly equipped with electric fans. The local market was completely cleared of direct-current fans. General Electric fans adapted to an 80-volt current were in great demand for use on the war ships. Many fans were ordered and shipped from the East for use on the transport steamers to alleviate the suffering of the men from overcrowding in the tropics.

CANADIAN NOTES.

OTTAWA, Ont., July 30, 1898.

MR. P. E. MARCHAND, formerly superintendent for R. Anderson, has started in business on his own account, as electrical contractor and mechanical expert, at 128½ Sparks Street, Ottawa.

THE AGREEMENT between the city of Brantford, Ont., and the Brantford Electric & Operating Company for street lighting has been signed, the franchise being for ten years. The company will expend immediately about $10,000 on additional plant.

THE PROJECT to produce power by the construction of a channel from the Welland to the Jordan Rivers, Ont., has again been revived. Mr. William Pearson, of Oswego, is said to have pronounced the scheme feasible from an engineering standpoint.

A PROPOSAL is to be made to the City Council of St. John, N. B., to secure legislation to take over the property, privileges and franchises of the St. John Electric Street Railway Company, to be conducted by the city in the interests of the ratepayers.

THE OTTAWA ELECTRICAL ASSOCIATION has been formed, and officers elected as follows: Honorary president, Thomas Ahearn; president, J. Murphy; vice-president, P. E. Marchand; secretary, E. Bailey; treasurer, B. Nolan. The objects of the association are the advancement of education and mutual help.

EX-MAYOR ELLIOTT, of Brantford, Ont., representing the syndicate which has undertaken the construction of the proposed new railway between Brantford and the city of Woodstock, has just been conferring with Toronto members of the syndicate respecting arrangements for an early start in building the road. Mr. D. A. Middleton, of Ottawa, has just completed a survey of the road, which traverses as fine a stretch of agricultural country as is to be found in Canada, and is particularly adapted for railway construction, the average per mile of cost of construction being about 10 per cent. less than the ordinary estimate. The new line will be 26 miles in length. It is expected that active operations will commence on September 1 next.

FRENCH NOTES.

(From Our Own Correspondent.)

PARIS, July 4, 1898.

PRIZE FOR A LOW CANDLE-POWER LAMP.—The Society for the Encouragement of National Industry has offered a prize of 2000 francs for an electric incandescent lamp having a candle-power not to exceed two decimal

candles, and to consume 0.1 of an ampere at a pressure of 100 volts. The prize will be awarded in 1899, if the requirements have been successfully met. If the problem is not entirely solved, however, the society reserves the right to record the results obtained. Models, descriptions, specimens, etc., should be addressed to the office of the secretary of the society, 44 rue de Rennes, before December 31, 1898.

ELECTRICAL APPARATUS.—The utilization of electric energy for various purposes in domestic life and in the smaller industries is realized more and more, and special applications have already been made in a very great number of cases in France, as well as abroad. A prize of 2000 francs will be given in the year 1900 to the inventor of a collection of apparatus and tools electrically operated, for the above named purposes, and applying to a special trade or small industry which shall be determined upon, either manufacturing, agriculture or otherwise. The models, memoirs, descriptions, samples, etc., should be sent, postpaid, to the secretary of the Society of Encouragement of the National Industry, 44 rue de Rennes. They must be sent before December 31, 1899.

SILVERING, GILDING, COPPERING AND NICKELING ALUMINUM.—According to a recent process patented by Messieurs Lenseigne and Leblanc, aluminum objects, in order to be covered electrolytically with other metals, are freed from verdigris by a diluted solution of soda or of caustic potash, or in a solution of hydrochloric acid diluted one-tenth. They are then submitted to a vigorous brushing in pure water. Thus prepared, the objects can be covered with a layer of gold, silver, copper or nickel by means of the following baths: Gold—Chloride of gold, 40 grams; cyanide of potassium, 40 grams; phosphate of sodium, 40 grams; distilled water, 2 litres. Silver—Nitrate of silver, 20 grams; cyanide of potassium, 40 grams; phosphate of sodium, 40 grams; distilled water, 1 litre. Copper—Cyanide of copper, 300 grams; cyanide of potassium, 450 grams; phosphate of sodium, 450 grams; distilled water, 5 litres. Nickel—Chloride of nickel, 70 grams; phosphate of sodium, 70 grams; distilled water, 1 litre. These baths must be heated between 60 and 70 degrees C., and the temperature must be maintained constant during the entire operation. The anodes must be of the same metal as that which is in solution in the bath.

SUBMARINE TELEGRAPHY.—At the Academy of Sciences, M. A. Cornu presented the memoir of M. E. Hardy "On Some Experiments of Submarine Acoustic Telegraphy, with the Aid of a Microphone with Pivots." We know that the sonorous vibrations are conveyed through the water at great distances, but as the amplitude of the vibrations is weak, in order to perceive from afar the submarine noises it is necessary to employ apparatus very sensitive to the sonorous vibrations, but entirely resisting to the exterior perturbations. The experiments made at Cherbourg, by order of the Minister of Marine, have shown the great superiority of microphones with pivots for this kind of observation, and make their application to submarine telegraphy so beneficial that the Minister of Marine has authorized their use. The microphone with pivots is made of a small disc of carbon, fixed at the centre of the vibrating plate. The elements of the pivots are set around this disc. Each pivotal element is composed of a movable portion, with counterweights, in order to regulate the pressure on the carbon. A small quantity of mercury surrounds each pivot, and facilitates the passage of the electric current through the movable piece without in any manner interfering with its mobility.

THE ELECTRIC AUTOMOBILE IN FRANCE.—The Professional Syndicate of Electrical Industries, the Syndicate of Electrical Machines and the Automobile Club of France have organized, through the initiative and under the presidency of M. E. Sartiaux, president of the Professional Syndicate of Electrical Industries, a "commission for the studies relative to furnishing electric current to automobiles." This commission is composed of M. E. Sartiaux, president; M. E. Hospitalier, vice-president; M. Geoffroy, secretary; MM. Bean, Eschwege, E. Fontaine, Geoffroy, Hérard, Mildé de la Valette, members. This mixed commission has for its object to organize, at first in the departments of the Seine and the Seine-et-Oise, then in the whole of France, a collection of ways and means to facilitate the charging of electric vehicles, and eventually the replacing of exhausted accumulators with charged accumulators. It will draw up a map and a list, in order to make known the points where the recharges could be effected and the conditions under which they will be done (prices, hours, etc.). It will endeavor to obtain the best conditions possible, or to promote the multiplication of these points in such a manner that in a few years an electromobile will be capable of traversing France with as much facility as an automobile with petroleum does to-day.

THE PRIZE COMPETITION OF AUTOMOBILE CABS.—The prize competition of automobile cabs, which has just been concluded, was organized by the Automobile Club of France, and had for its object the determination of the kind of vehicle best suited for city service. Let us say right here, that the results have been absolutely conclusive. They have demonstrated that the automobile cab complies admirably with the many exigencies of city traffic, the rigorous tests to which they have been submitted, both on the level road, as well as on the uneven road, with heavy grades, having proven this. M. Forestier, Inspector-General of Bridges and Roads, presided over the commission that had charge of the competition, which commenced on June 1, and was concluded on Sunday, June 12. The tests imposed consisted of nine trips about Paris. Each carriage was accompanied by a commissioner, who was to make a report and note a series of observations. Of the twenty-six carriages entered only twelve took part in the prize competition, of which eleven were electric and one petroleum. On the first day of the competition the weight of every vehicle was ascertained. The carriages, with their entire complement of passengers and baggage, set out on the road which goes alongside the Seine, between the Bridge of Puteaux and that of Neuilly. On this part of the route, which is level, posts were erected at distances of one kilometre. The first step consisted in determining the consumption of current while running on the level. For that purpose the carriages traversed a distance of 1000 metres, going and returning, at different speeds. With regard to the petroleum carriages, they measured only the velocity. The carriages were then run over the road from Suresnes to Mont Valérien, to a point where the ascent is, in the average, 81 millimetres per metre. There, over a distance of 500 metres, they proceeded with tests of consumption on the ascent in the same manner as for tests of consumption on the level. The first day of the competition was concluded with tests of braking and of starting on an ascent averaging 120 millimetres per metre. Before the braking tests, the carriage, running down a descent at a minimum pace of 10 kilometres an hour, had to stop quickly on a given signal. The distance traversed from the moment the signal was given until the complete stopping of the carriage, was measured. The same operation was gone through during the ascent, but in this case the recoil, or fall-back, after stoppage, was measured. As to the tests for starting on the ascent, they were carried on in the same manner as for starting on the level. The remaining days of the competition, from June 2 to June 10, were employed in making trips in Paris. These trips, to the number of three, were laid out by the Count de Chasseloup-Laubat; their distance was about 60 kilometres, and they were chosen so that they would present all the difficulties of traffic which could be encountered in Paris. Each carriage was to make these three trips three times, in the nine consecutive days, at the rate of one trip per day. On June 11 were repeated the tests of traction of the first day, and on the 12th, to close the competition, the carriages made the journey from Paris to Versailles, going and returning. The consumption of petroleum of carriage No. 12, the only one which was not electric, was 14 litres per day. While awaiting the report of this competition, which is now being published, and which will inform us of all the details of these interesting trials, we will give the list of prizes awarded by the commission: First-class Carriages with Two Seats—First Prize: 1000 francs. Carriage No. 25. Cab, with electric motor, system Jeantaud. Second Prize: 600 francs. Carriage No. 13. Coupé, with electric motor, system Jenatzy, of the General Transportation Automobile Company. Second Class, Carriages with Four Seats—First Prize: 1000 francs. Carriage No. 16 Coupé à galerie, with electric motor; system, Krieger.

General News.

New Incorporations.

THE SILOAM SPRINGS TELEPHONE COMPANY, Clayton, Ill., has been organized, with a capital of $1500. The incorporators are G. L. Thompson, John Padgett and John W. Butz.

THE VIGO LIGHT & POWER COMPANY, Terre Haute, Ind., has been incorporated with a capital stock of $50,000. The incorporators are W. R. McKeen, H. Holman, James, A. J. and J. A. Crawford.

THE FAIRFIELD TRACTION COMANY, Lancaster, Ohio, has been formed by Henry B. Peters, William Davidson, George P. Rising, L. N. Ingram and Frank C. Neeb, with a capital stock of $100,000.

THE ADAMS-BAGNALL ELECTRIC COMPANY, Grand Rapids, Mich., has been incorporated for the purpose of manufacturing the Adams-Bagnall inclosed arc lamp. The company is capitalized at $235,000.

THE EAST ST. LOUIS & COLLINSVILLE ELECTRIC RAILROAD COMPANY, East St. Louis, Ill., has been formed with a capital stock of $2500. Among those interested are William Ortgrier, T. T. Ramey and W. E. Hadley.

THE CONSUMERS' ELECTRIC COMPANY, Cleveland, Ohio, has been incorporated with a capital stock of $30,000. The incorporators are A. W. Oppmann, Louis Perczel, Charles P. Salen, John Meckes and George B. Merrell.

THE UNION ELECTRIC COMPANY, Camden, N. J., has been incorporated with a capital stock of $6000. The incorporators are H. George Lewis, Charles J. Harr, H. G. Kepler, Charles H. Hagey, Joseph F. McCarthy and Samuel H. Richards.

THE TUXEDO & EMBLA PARKS WATER & ELECTRIC LIGHT COMPANY has been incorporated at Baltimore, Md., with a capital stock of $25,000. Among those interested in the company are G. O. Wilson, H. A. Leonard, J. H. Neudecker, F. E. Wilson and W. F. Smith.

THE RIVESVILLE & MONTANA TELEPHONE COMPANY, Rivesville, W. Va., has been incorporated with a capital stock of $50,000. Among those interested are C. E. Gaskill, F. B. Clayton, J. S. Koogle, J. D. Arnett, F. F. Prickett, A. S. Prichard, J. S. Cox and J. G. Floyd.

THE KINDERHOOK POWER & LIGHT COMPANY, Troy, N. Y., has been incorporated with a capital stock of $50,000. The following are the directors of the new company: James Purcell, Valatie, N. Y.; James R. Hughes, James Hogan and John Ritz, of Stuyvesant Falls; William D. Barnes, of Brainard.

The Telegraph and Telephone.

ZANESVILLE, OHIO.—A new telephone line is being built between Zanesville and McConnellsville.

PEORIA, ILL.—The Citizens' Telephone Exchange Company will petition the City Council for a franchise.

EVANSVILLE, IND.—The Evansville Telephone Company has been granted a franchise to conduct business in this city.

BELLEFONTAINE, OHIO.—The city will issue $10,000 in bonds for a new fire-alarm system and headquarters for the fire department.

SAVANNAH, GA.—The Tyson Telephone Company has obtained permission from the Council of this city to build its lines within the city limits to its exchange.

DALLAS, TEX.—A franchise to erect and operate a district messenger service, fire and police telegraph has been granted to O. J. Gorman and associates, of this city.

WABASH, IND.—The Central Union Telephone Company is preparing to build a new long distance line from Goshen to Elkhart, and another from Goshen to Ligonier.

MAMARONECK, N. Y.—The New York Telephone Company opened an exchange in this village on August 1. The office is in the bank building, on the Boston Post Road.

DENISON, TEX.—A company of Chickasaw capitalists will build a telephone line from Tishomingo to Denison, covering the greater portion of the eastern half of the Chickasaw nation.

NILES, MICH.—Dowagiac capitalists will establish a new telephone system here to compete with the Bell interests. It is stated that the new system will be connected with the independent long distance line.

WARREN, OHIO.—A small telephone war is imminent in Warren and Niles. The Central Union Telephone Company has been charging $18, $24 and $30 a year, and the new company has made its rates $12 and $18.

BELVIDERE, ILL.—The Belvidere Telephone Company will soon begin the construction of a line to Kingston. The erection of this line will give this place 300 more miles of telephone connections in Northern Illinois and Iowa.

MANSFIELD, OHIO.—At a meeting of the stockholders of the Mansfield Telephone Company, recently held, most of the stock was subscribed for. Application from Mt. Vernon and another place for some of the stock were received.

PEKIN, ILL.—A new telephone line is to be built between this city and Havana. It will pass through Hainesville, Spring Lake, Manito, Forest City and other places which have heretofore lacked telephone facilities. A copper metallic line will be built.

LOWELL, MASS.—The New England Telephone Company will build during the present season a new trunk line from Machiasport to Calais, Me., about 40 miles, with a spur line about 12 miles long to Lubec. Also a trunk line from Manchester, Vt., about 30 miles.

SPARTANBURG, S. C.—The Home Telephone Company has applied for a charter, and expects to organize soon and begin work. It proposes to connect its lines to about twenty neighboring towns in three or four counties. The construction work will be of the best.

ATCHISON, KAN.—Mayor Donald vetoed the ordinance granting a franchise to a new telephone company to establish an exchange in this city, but the Council passed the ordinance over the veto. The new company will fix its rates at $2 per month for business 'phones and $1 for residences.

BEL AIR, MD.—The Baltimore & Bel Air Telephone Company has asked permission of the County Commissioners of Baltimore County to string telephone wires from Upper Falls to Franklinville, and thence to Jerusalem. The Baltimore & Harford Telephone Company has asked for permission to string wires from Bradshaw to Reckord.

SUMMIT, N. J.—There is a small war between the Township Committee and the New York & New Jersey Telephone Company, which has taken the form of the destruction of property. On July 17 the wires and cables of the telephone company were cut from the poles. The Township Committee declares that the wires were strung without a franchise, and has been demanding that the poles and wires be taken down. After the work of destruction was finished the telephone company set a gang of men to work to repair the damage. The men were not interfered with, contrary to general expectation.

TRENTON, N. J.—The State Board of Taxation has disposed of two appeals made by the New York & New Jersey Telephone Company. The company appealed from an assessed valuation of $100,000 placed on its property in Orange in 1897, and from an assessment of $43,000 on its Elizabeth property for the same year, but the board fixed it at $47,752.28. The company asked to have the Orange valuation reduced to $35,000. In the Elizabeth case, the board suggested that the City Solicitor of Elizabeth and Treasurer Snow, of the telephone company, have a conference and seek to reach an agreement. They did so, and the result that a valuation of $40,000 agreed upon by them was confirmed by the board.

WASHINGTON, D. C.—Proceedings have been commenced in the District Supreme Court against the Chesapeake & Potomac Telephone Company for the purpose of testing the recent act of Congress, reducing the rate for telephone service in the District. An application for a mandamus was filed by Mr. O. G. Staples, asking that the telephone company be compelled to furnish him with a telephone service, and an injunction was asked by J. F. Manning & Co., enjoining the telephone company from removing its instrument from the complainant's office. Both of these suits are in the nature of test cases, and will, it is stated, be vigorously supported by the Telephone Subscribers' Association. It is understood that the company will make a hard fight in the hope of securing an adverse decision upon the new law, and thus be enabled to maintain the old standard of rates.

Electric Light and Power.

FLUSHING, L. I.—The Citizens' Lighting Company of Far Rockaway has been sold to the Queens Borough Electric Light & Power Company of the same place, which has executed a mortgage with the Colonial Trust Company for $250,000 at 5 per cent.

LIVINGSTON, MONT.—The electric light plant of this city was almost entirely destroyed by fire, entailing a loss of $32,000. There was an insurance of $24,000. The plant was the property of the Livingston Water Power Company, and will be rebuilt at once.

DULUTH, MINN.—A special election will be held on August 30 to vote on the proposition to issue bonds to the amount of $100,000 for a municipal electric light plant. The Council committee has submitted a report, estimating the cost of the necessary plant at $89,000.

CHICAGO, ILL.—Sealed proposals will be received until August 30 for contracts for the erection of an electrically operated traveling crane for the new pumping station at Springfield Avenue and Central Park Avenue, in this city. The proposals must be made out on the blanks furnished at the office of the Department of Public Works. Mr. L. E. McCann is the Commissioner of Public Works.

DETROIT, MICH.—At the recent meeting of the public lighting commission, Secretary Starring submitted a report showing that the average cost of operating the city arc lamps during the year was $51.85, against $64.19 for the preceding year. The total expenditures for 1744 arc lights was $90,439.85. During the year the aggregate current generated was 3,281,615-kw hours, of which 2,975,019 were used for arc lighting and 306,596 for incandescent lighting.

KALAMAZOO, MICH.—The Kalamazoo Electric Company has passed into new hands, Mr. W. A. Foote, of Jackson, having purchased a three-fourths interest in it. The new organization, which has a capitalization of $100,000, is officered by the following named gentlemen: President, W. A. Foote, of Jackson; secretary, S. S. Hulburt, of Battle Creek; treasurer, B. Foote, of Jackson. Mr. W. A. Foote is interested in the Jackson, Albion and Battle Creek electric companies.

DES MOINES, IA.—The General Electric Company is preparing to make some extensive improvements in its plants in this city. The Fort Wayne water-power plant will be extensively developed. The improvements will give the company duplicate plants in the city. Five water wheels will be installed at the Fort Wayne plant, and the steam-power machinery will be abandoned. It is the intention of the company to use the water-power plant in future when there is a sufficient head of water, and the Edison plant when steam is necessary.

WASHINGTON, D. C.—A new division has been created in the District government by the commissioners, to be known as the Electrical Department of the District of Columbia. All matters pertaining to street lighting, the electrical equipment of underground and overhead trolley roads, underground conduits for electric lighting and power, telephone, telegraph and other purposes, all overhead wires and poles and exterior work relative to the District of Columbia, fire-alarm systems, police telegraph service, etc., will be supervised by the new department.

The Electric Railway.

FITCHBURG, MASS.—The Fitchburg & Suburban Street Railway has been opened for business between Fitchburg and Leominster.

MILWAUKEE, WIS.—It is stated that it is the intention of the Milwaukee Electric Railway & Light Company to expend $1,000,000 in improvements on its property before the end of the present year.

NEW BRITAIN, CONN.—The third rail line between New Britain and Bristol, which is a continuation of the third rail line from Hartford, was tested a few days ago. The trial trip was made by officials of the road, and everything worked well.

BUFFALO, N. Y.—It is stated that representatives of Buffalo capitalists have started for Honolulu, Hawaii, to secure street railway privileges in that city. It is understood that they have the backing of capitalists who control the Buffalo Street Railway Company.

PITTSBURG, PA.—The large car barn of the Penn Avenue branch of the Consolidated Traction Company was destroyed by fire on July 24. The loss, in addition to the building, includes forty cars, the total value of the property destroyed being about $150,000. It is said that there is an insurance of $110,000.

OCONOMOWOC, WIS.—Upon the completion of the present extension of the Milwaukee Street Railway & Light Company's line to Waukesha, and other improvements, the company will take up the proposition to extend its line to Oconomowoc. This work will involve an expenditure of at least $200,000.

TOLEDO, OHIO.—The new electric railway to be built from Toledo to Lyons, Ohio, has received the indorsement of the Chamber of Commerce, and the work of construction will now go on with all speed. It is stated that the road will bring into close communication with Toledo nearly 75,000 people in the country districts.

NEW YORK, N. Y.—Daniel Cortelyou has begun a suit against the Midland Electric Railroad Company of Staten Island to recover 5 cents. This sum was paid by him under protest as an extra fare. The suit is in reality a test one to determine the right of the Midland Company to charge two fares instead of issuing transfers.

MARION, IND.—George Sweetser, vice-president of the Marion Bank, has been appointed receiver of the Indiana Traction Company, on a petition from Charles Lohman, former secretary of the company, who claims that $1000 is due him. The Indiana Traction Company is a corporation formed to build an electric railway from Marion to Indianapolis.

BUFFALO, N. Y.—The Aldermanic committee on streets has reported to the Board of Aldermen in favor of granting the petition of the Buffalo Traction Company to charge a 5-cent fare on its lines, provided it makes an arrangement with the Buffalo Railway Company, whereby passengers may get transfers from one company's lines to the other on the payment of a single fare.

VINCENNES, IND.—The street railway company recently advertised for women to act as conductors on its cars. More than fifty applications were received, from which five young women were selected for the positions. They will receive a salary of about $5 per week. The uniform which they will wear will resemble a bicycle costume, and they will wear caps on which the word "Conductor" is inscribed.

SANDUSKY, OHIO.—The Sandusky Street Railway has been sold to Judge C. S. Bentley, of Cleveland, for $60,024, which is said to be two-thirds of the appraised value. Judge Bentley represented a syndicate of Cleveland and Norwalk capitalists and 95 per cent. of the first mortgage bondholders. The line will be improved and probably consolidated with the People's line, which will be purchased later by the same syndicate.

NEW YORK, N. Y.—The State Railroad Commissioners have granted permission to the Kingsbridge Railway Company, the North End Street Railroad Company and the Fort George & Eleventh Avenue Railroad Company to construct their respective railroads in the upper part of the city. All these lines will be operated by electric power. The plans of these companies were outlined in The Electrical World of June 4, 1898.

GREENSBURG, PA.—The Greensburg, Jeannette & Pittsburg Street Railway has been sold to a syndicate of Harrisburg capitalists, at the head of which are Benjamin F. Myers and Patrick Russ. It is the intention of the new company to improve the road and rolling stock and extend the line to Irwin this summer. The company also proposes to purchase the Greensburg

& Hempfield line, change it to the standard gauge and extend it to Mount Pleasant in the early future.

KANSAS CITY, MO.—The contract for the construction of the Broadway electric line has been awarded by the Metropolitan Street Railway Company to L. E. Myers, of Chicago. It provides that the track shall be laid for the operation of the cars in ninety days. The roadbed will be of the most approved style of construction, the rails being 70 feet long. The joints will be welded and the rails will be laid in cement. When this line is completed it will be one of the best in the State.

SOMERVILLE, N. J.—The New York & Philadelphia Traction Company on July 17 started its first car on the line between this place and Bound Brook. This opens the first link of five miles on the proposed electric road between New York and Philadelphia. The Traction Company is now building its line in Bound Brook to a point one mile east of the town, where it will connect with the line of the Brunswick Traction Company. Work is also in progress which will connect the New York & Philadelphia Traction Company's lines with Dunnellen, Princeton and Trenton.

WORCESTER, MASS.—A movement is on foot for the consolidation of the Worcester & Marlboro and the Marlboro, Framingham & Southboro electric street railway companies. If the plan is consummated, it will be possible to ride on electric cars from West Warren to Boston, through Worcester, Framingham, Natick, Wellesley and the Newtons, a distance of about 80 miles. The Marlboro, Framingham & Southboro line is in process of construction. The deal will be made in accordance with the general law governing such transactions, the Worcester & Marlboro Company leasing the other line.

NEW YORK, N. Y.—The employees of the Metropolitan Street Railway Company have formed an organization with protective and benevolent features, known as the Metropolitan Street Railway Association. Each member before he is elected must certify that he is temperate and of good habits. The association has the approval of the Metropolitan Company. The initiation fee is $1, and the dues are 50 cents a month. Members in good standing will receive an allowance when incapacitated by sickness or accident. It is stated that the association will practically take the place of a labor organization.

CHICAGO, ILL.—It is stated that there is a possibility of consolidating the three street railway properties in Chicago within the next sixty days. No details as to the proposed plans in negotiating the consolidation can be obtained. It is likely, however, that a new corporation will be formed, and the stock of the different companies placed in the hands of a trustee at a certain price, payable in cash, or in cash and stock of the new company. The present capitalization of the three companies is as follows: West Chicago Street Railway Company, $13,089,000; North Chicago Street Railroad Company, $10,000,000; Chicago City Railway Company, $12,000,000, making a total of $35,000,000.

BUFFALO, N. Y.—The Buffalo, Tonawanda & Niagara Falls Electric Railroad Company on July 16 opened for traffic a new extension of its line. This new line begins at the corner of Tonawanda and O'Neil Streets on the northerly limits of the city of Buffalo, and follows O'Neil Street to Niagara Street, and thence along Niagara Street about one mile to the ferry on Niagara River, which runs between the terminal of this new extension and various resorts of Grand Island. This line will be further extended along Niagara street to the village of Tonawanda, and will prove to be the most popular electric line between Buffalo and Niagara Falls, as it follows the bank of the Niagara River the entire distance. Mr. Henry B. Smith, of Bay City, Mich., is principal stockholder of this company.

Legal Note.

TELEPHONE SWITCHBOARD DECISION.—A patent decision of great importance to the independent telephone movement was rendered by Judge Showalter, of the United States Circuit Court at Chicago, on July 29, in the case of the Western Electric Company v. Kellogg Switchboard & Supply Company, in which the complainant sought to restrain the defendant company from installing a switchboard for the Kinloch Telephone Company of St. Louis. Judge Showalter denied the preliminary injunction asked for. The complainant applied for an injunction on the Firman patent, which expires on January 19, 1899, and the validity of which has been recently sustained by Judge De Haven, of the United States Circuit Court, Northern District of California, upon very narrow lines. The decision in California has been appealed to the United States Circuit Court of Appeals; and relying upon that decision, the complainant here sought to obtain an injunction and thus prevent the Kinloch Company from beginning operations as had been planned. It was shown by the affidavits of Prof. Elisha Gray, Professor Carhart of Michigan University Milo G. Kellogg and F. W. Dunbar, that there was no infringement. Professor Jackson, of the University of Wisconsin; T. D. Lockwood, C. E. Scribner and others gave affidavits to the contrary effect. The court stated in substance that it was his impression that there was no invention in the Firman patent; that he was unable to see upon what ground Judge De Haven had sustained the validity of the patent, in view of the prior state of the art, and especially in view of the Dumont English patent of 1851, and advised counsel for complainant that, in his opinion, if the case went to the Circuit Court of Appeals they would have great difficulty in sustaining that opinion. He also stated that one of the decisions cited by Judge De Haven, in his opinion, has been discredited by the Circuit Court of Appeals of this circuit in an opinion filed but a few days ago, and that it was very doubtful, to his mind, whether there was any invention in the Firman patent, or if there was invention, it was extremely doubtful if defendant infringed. He said, however, that he preferred to place his decision at this time broadly upon the principle that the telephone company at St. Louis was engaged in a public service; that the question was doubtful, and that the defendant switchboard company was undoubtedly solvent and would be able to pay any damages that might be recovered if the complainant should succeed in establishing the validity of the patent and the fact of infringement; and that it would, under such circumstances and also in view of the early expiration of the Firman patent, be an abuse of discretion for him to entertain the petition for an injunction, which he therefore denied.

The Kinloch Telephone Company is one of the most formidable competitors which have yet entered the field against the Bell Telephone Company. It has established an exchange in St. Louis, in which it has laid about 105 miles of conduit, expended over $1,000,000 and has about 5000 instruments already installed. The switchboard, which is being manufactured by the Kellogg Switchboard & Supply Company, of Chicago, will be completed and service for subscribers will commence within a few days. It is being made under the patents of Milo G. Kellogg, of Chicago. It has a present capacity for 6160 telephone lines, and provides for an ultimate capacity of over 20,000 lines in one exchange. The largest telephone switchboard heretofore constructed has had a capacity for switching only about 6000 telephone lines in one exchange. The Kellogg Company has been engaged on this board for about a year.

Personal Note.

MR. A. CHURCHWARD, who was so long connected with the Excelsior Electric Company as its electrical engineer, has become associated with the Fort Wayne Electric Corporation, Fort Wayne, Ind. Mr. Churchward is well known in electrical circles through his work with single-phase alternating motors, rotary transformers, etc. The Fort Wayne Electric Corporation is to be congratulated on securing the services of Mr. Churchward. It is understood that as soon as its new factory is completed the company will enter extensively into transmission work.

Trade and Industrial Notes.

THE FOSTORIA INCANDESCENT LAMP COMPANY, Fostoria, Ohio, it is stated, proposes to increase its plant to twice the capacity of its present works.

THE VILLAGE OF RICHMOND, MICH., is to have an electric light plant with Westinghouse electrical apparatus. The steam plant will be furnished by the Ball Engine Company, Erie, Pa.

MICA.—For the convenience of the Pacific Coast trade, Mr. A. O. Schoonmaker, of New York, carries a stock of mica with his agents, Messrs. Reger & Atwater, of San Francisco, Cal., for prompt delivery.

THE WESTERN ELECTRIC COMPANY, it is stated, is about to open an establishment in Detroit, Mich., and has filed articles of incorporation for a company in that State, with a capital of $1,000,000.

MR. A. O. SCHOONMAKER, 158 William Street, New York City, has issued a folder, giving views of the mica mines in India, whence Mr. Schoonmaker obtains his supply of this important material. Mr. Schoonmaker handles mica uncut or block, cut to any size or pattern.

IN ADDITION to carrying a large and well-assorted stock of the celebrated Loricated conduit for interior wiring, the Central Electric Company, Chicago, announces that it has full and complete lines of all sizes of circular loom conduit and plain brass and iron armored interior conduit and all fittings.

MESSRS. J. W. HILL, president, and H. E. Teachout, secretary, of the Mutual Telephone Company, Des Moines, Ia., after a four days' inspection tour among telephone manufacturers, placed an order with the Sterling Electric Company, Chicago, for a 2000-drop metallic circuit board before leaving for home.

THE BALL ENGINE COMPANY, Erie, Pa., has furnished engines aggregating 550 horse-power for the isolated electric plant of the Peruna Drug Manufacturing Company, Columbus, Ohio. These engines are direct connected to Siemens & Halske generators, and the plant, it is stated, will be, when completed, one of the most complete in the city.

THE WALKER COMPANY has received a large order for electrical apparatus from its Paris agency, the Exploitation des Procedes Electriques Walker. The order calls for 500 complete street railway equipments, comprising 1000 25-hp motors, 1000 controllers and 500 trolleys. It is stated that this apparatus is destined to Italian, French and German cities. The order represents a money value of about half a million dollars, and it is to be filled in fifteen months.

MR. F. S. BLACKALL, of Blackall & Baldwin, 39-41 Cortlandt Street, acting for the Shanghai, China, Municipal Council, is inviting tenders for the supply of an electric light plant complete, including engines and boilers, which are to be used in increasing the existing plant in Shanghai. The apparatus needed is two 100-kw alternators, direct coupled to horizontal medium speed engines, switchboard and instruments, water-tube boilers, etc. Sealed proposals must not be sent later than August 10.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has recently issued a little folder calling attention to its self-contained automatic telephone hook. This hook was designed by the manager of its telephone department, and is manufactured exclusively by the company. It is claimed that it can be installed in a smaller space than any other hook on the market. Its installation is very easy, as the hook is put together complete in one piece of apparatus and all that is necessary is to screw it in the telephone box.

MESSRS. JULIUS ANDRAE & SONS COMPANY, Milwaukee, Wis., who are the Milwaukee selling agents for Lundell fan motors, have succeeded in placing these goods in many of the largest local business houses, hotels and theatres, including the Alhambra Theatre, Palm Garden and Kroeger Brothers' large clothing establishment. Mr. James S. Healey, of the company, has just returned from a trip through Southern Wisconsin in the interest of Andrae telephones and electrical supplies. He reports trade exceptionally good in that section of the Northwest.

THE ELECTRIC STORAGE BATTERY COMPANY last week closed a contract, through its Chicago office, with the South Side Elevated Railroad Company in that city for two batteries, each of 500-kw capacity. One of these batteries will be installed on the company's property at Twelfth Street and the other at Sixty-first Street, and both will be used to regulate the fluctuations of the load and to maintain an even potential at extreme points on the line. Both batteries will be installed with tanks and bus bars of sufficient size to permit of doubling its capacity if it should be found desirable to do so.

THE WALKER COMPANY has appointed Mr. J. S. Webster as sales agent for Minnesota and the Dakotas, with office at 706-707 Lumber Exchange, Minne-

apolis. Mr. Webster has been identified with the sale of Walker apparatus for the last two years, but his time has mostly been taken up in connection with installations and the design of special apparatus. A 90-kw direct connected lighting plant, installed for Wyman, Partridge & Co., Minneapolis, is one of the neatest and most complete in the country, and a view of the engine room is given in the latest Walker pamphlet, which shows some interesting Walker lighting plants, including the Astoria Hotel in New York.

THE RASTER CARBON RHEOSTAT COMPANY, Chicago, reports that it is now in a position to furnish all kinds of motor starting boxes with automatic release, as well as controllers, field regulators and dimmers. Its trade has been exceptionally brisk for this time of the year, and is constantly growing. The W. R. Garton Company, of Chicago, is selling agent for the Raster Carbon Rheostat Company, and has closed some very valuable contracts. Mr. Garton, president of the W. R. Garton Company, and consulting engineer for the Raster Carbon Rheostat Company, has lately made some extensive trips in the interest of this business, and his labors have been crowned with success. The Raster Carbon Rheostat Company is getting out a new dimmer catalogue, as well as a circular illustrating its automatic motor starter. In this catalogue is illustrated complete equipments for theatres, also a very handsomely designed switchboard for theatres, whereby the dimmers may be located at some convenient but distant point, while the controllers are so arranged on the switchboard that they may be placed in such a position in the theatre to enable the operator to work in harmony with the performance. This company has lately manufactured many special forms of resistances, and in every instance they have proven highly successful and satisfactory, both mechanically and electrically. It has been obliged to increase its facilities and extend its factory.

TRADE AND MISCELLANEOUS PUBLICATIONS.

THE CROUSE-HINDS ELECTRIC COMPANY, Syracuse, N. Y., has issued a pocket catalogue of its knife switches, switchboards, panel boards, etc., etc. The catalogue contains forty-six pages, and the illustrations of the various articles are very clear. This company is the sole owner and manufacturer of the Hinds patent tubular arm switch.

STORAGE BATTERIES IN LIGHTING AND POWER STATIONS.—The Electric Storage Battery Company, Philadelphia, Pa., devotes its circular No. 42, just issued, to an illustrated description of the installation of chloride accumulators in the plant of the Claremont Electric Light Company. Claremont, Vt. This plant exemplifies the advantage of the application of storage batteries to small lighting installations, and is said to be one of the most unique of its kind in this country.

THE PERU ELECTRIC MANUFACTURING COMPANY, Peru, Ind., manufactures a very complete line of carbon batteries, porcelain cutouts, insulators and tubes, and illustrates these apparatus very completely in a catalogue and price list just issued. This company is one of the pioneers in the manufacture of open circuit carbon batteries, and it has been its aim to produce a high-grade battery, using only the very best material, and at the same time to sell the product at as low a price as is consistent with best quality.

"ELECTRIC MINE HAULAGE" is the title of a very artistic catalogue just issued by the Baldwin Locomotive Works, Philadelphia, and the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. It describes and illustrates electric mining locomotives for underground haulage. In designing these locomotives the range of practical requirements has been considered. Their compactness makes them perfectly adaptable to low and narrow entrances, and by reason of the absence of moving parts exposed to external injury, mechanism of the simplest character possible, and running parts readily accessible of replacement, the cost of maintenance is brought to a minimum.

THE L. P. & D. TRANSMITTER COMPANY, Montpelier, Vt., is sending to every electric light station in the United States a copy of a catalogue just issued by it, describing and illustrating its system of power transmission. The peculiar properties of the L. P. & D. system of belting are as follows: The driver and driven may be close together or the belt centres may be any distance apart. The strain on the belt is reduced and the friction on the bearings is less than in straitway belting. All the advantages of a friction clutch are obtained, and none of the disadvantages. This catalogue will enable those who are not familiar with this system to obtain a better understanding of its availability in electric light stations. A free copy may be obtained by addressing the company.

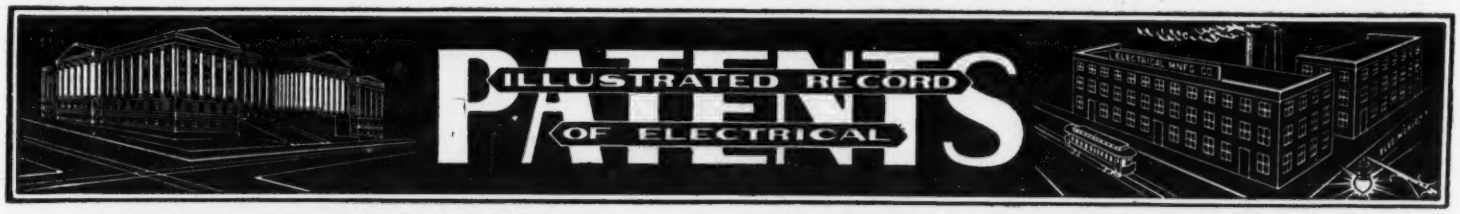
THE RELIABLE ELECTRIC MANUFACTURING COMPANY, Worcester, Mass., has recently issued a neat catalogue describing and illustrating the electrical goods manufactured and dealt in by it. This company furnishes the best and most up-to-date telephone instrument in the market, and has in its employ men from most of the prominent factories in Europe, with years of experience in the work. Its telephone instruments are neat, serviceable and reliable. The transmitter is so delicately adjusted that the slightest sound can be distinctly heard, at the same time giving perfect articulation, yet it does not easily get out of adjustment. It has been thoroughly tested on long distances and in general use, and has given excellent satisfaction. The company makes some very neat interior sets.

A HUGE CATALOGUE.—The Western Electrical Supply Company, St. Louis, Mo., may safely claim to have published the largest general electrical catalogue of the year. Its general catalogue No. 14 is just out, and contains no less than 753 pages, and to enumerate the articles illustrated and described would be far beyond the limits of available space in these columns. Everything needed in all branches of the electrical line is listed. The illustrations are clearly executed, and the book complete is very neatly gotten up. For the convenience of customers in ordering by letter or telegraph, a trade number and code word are given to each article, the trade number to be used in ordering by mail and the code word in ordering by telegraph. The general contents of the book cover light and power machinery, fan motors, arc lamps, arc lights and station supplies, electric heating supplies, testing instruments, construction materials, tools and appliances, electric railway supplies, house goods and telegraph supplies, telephones and accessories, electric and combination fixtures and leather belting.

THE FIFTIETH ANNIVERSARY OF THE ROEBLING WORKS.—Not many concerns related to the electrical industries can boast of an existence of fifty years, but the John A. Roebling's Sons Company, Trenton, N. J., enjoys this distinction. Fifty years ago Mr. John A. Roebling moved his little business from Saxonburg, Pa., to Trenton, N. J. The transfer was made in the spring of 1848. To commemorate this interesting event the company has issued a souvenir catalogue, which the company is sending to its customers and friends to whom it may be of interest and value. It should be explained that the concern has really been in business fifty-eight years, J. A. Roebling, the founder, having started at Saxonburg in 1840. Fifty years of this time have been spent at the present site of the works in Trenton. In the catalogue the company illustrates to a certain extent the growth of its business, and in addition to this it has added some interesting data in regard to large bridges, with which the name of Roebling has been identified. These include the Brooklyn Bridge, the Niagara Suspension Bridge and others of great note. The main body of the catalogue refers particularly to wire rope and electrical wires. The tables have been thoroughly revised and brought up to date. The catalogue includes specifications and other valuable and interesting information of weatherproof copper wire, weatherproof galvanized iron wire, fire and weatherproof copper wire, underwriters' copper wire, office wire, annunciator wire and cables, lamp cords, magnet wire, rubber insulated copper wire, lead encased cable for electric light and power, lead encased telegraph cables, lead encased telephone cables, armored submarine cables and aerial cables. The Columbia rail bond is well illustrated, and its features and advantages well brought out. Considerable data about bi-metallic wire are given, and copper trolley wire, both round and in special shapes, is listed and described. The catalogue completely covers everything manufactured by this well-known establishment, and is a worthy production on a worthy occasion.

Business Notice.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 9-15 Murray Street, New York City.



UNITED STATES PATENTS ISSUED JULY 26, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

607,830. DEVICE FOR OPERATING ELECTRIC SWITCHES; J. H. Cary, of Springfield, Mass. App. filed Jan. 8, 1896. The combination of a source of electrical energy; suitable conductors; means for switching in a predetermined amount of electrical energy; one or more rotary electromagnetic motors in the circuit; a switch ring or equivalent device operated by the electromagnetic motor and a supplementary or derived circuit made or broken at will by the operation of the switch ring.

607,877. METALLIC GATE SCREEN; A. P. Prichard, of Tacoma, Washington. App. filed Sept. 9, 1897. In combination with a safe or vault, a screen, doors in the screen provided with openings or cutaway portions whereby they are permitted to fit over the knobs or handles of the doors, pivoted slides lying across the openings, said slides being adapted to come in contact with the handles or knobs by a forward movement of the screen and sound an alarm.

607,918. CROSSOVER FOR TROLLEY SYSTEMS; C. E. Davis, of Chicago, Ill. App. filed Nov. 21, 1896. A crossover for trolley systems having overrunning trolleys, comprising a broken trolley wire, an electrical connection between the two parts of said wire, a normally open bridge piece pivotally connected in proximity to one end of said broken trolley wire, and projecting above the same in the path of the trolley wheel so as to be moved to bridge the break when engaged thereby, a weight below the trolley wire connected with said bridge piece, so as to normally hold it open.

607,919. ELECTRIC TRAMWAY; A. Diatto, of Turin, Italy. App. filed Dec. 1, 1896. In an electric railway system, the combination with a vehicle, of an electromagnet, a magnet bar carried thereby, cords having a connection with the magnet, and springs having connection at one end with the vehicle and the other end with cords.

607,921. ELECTRICAL MEASURING INSTRUMENT; George K. Elphinstone, of London, and A. C. Heap, of Penn, England. App. filed May 13, 1898. The combination of the electromagnet core, the primary windings disposed thereon, the secondary winding, a pivoted or swinging coil mounted between the poles of the core, and included in close circuit with said secondary winding, and an indicating device operated by the swinging coil.

607,984. MAGNETIC ORE SEPARATOR; G. J. Crean, of Montreal, Canada. App. filed Jan. 7, 1898. A magnetic ore separator, comprising a series of stationary magnets arranged in the form of an arc; a hopper located adjacent to said magnets; a rotatable carrier adapted to travel across the surface of and in close proximity to said magnets and intermediate of same and

said hopper, and said carrier being adapted to receive movement from the ore particles running from said hopper and adhering to said carrier.

607,989. INTERIOR CONDUIT; E. E. Erickson and F. W. Erickson, of Boston, Mass. App. filed June 3, 1898. In interior conduit systems, an outlet insulator, consisting of an internally threaded metal member, composed of a disc, from one side of which extends two rings of different diameters; and an insulating member fitting over the ends of the rings and into the channel between them.

607,994. MICROPHONE; T. J. Howell, of London, England. App. filed Jan. 3, 1898. In combination in a microphone, a honey-comb disc having a series of cells, the front diaphragm, a screw-down cover to hold the diaphragm in place in front of the honey-comb disc, a rear plate extending across the series of cells in the disc and a conducting spring for forcing the rear plate with the honey-comb disc forward as a whole, the said cells being filled with carbon granules.

607,997. ELECTRICALLY SELF-PROPELLING VEHICLE; L. Krieger, of Paris, France. App. filed March 11, 1897. In an electrically self-propelled vehicle, the combination with steering wheels pivotally journaled upon opposite ends of a stationary axle, an electric motor connected to each wheel, and means for varying the speed of either motor to steer the vehicle.

608,013. REVERSING RHEOSTAT; I. E. Storey, of Philadelphia, Pa. App. filed Jan. 29, 1898. In a motor controller, the combination of a rotary shaft carrying a crank disc, an abutment on the disc, a toggle lever bearing at one extremity against the abutment and pivoted at a fixed point at the other, and a spring connected to the toggle joint.

608,015. SECONDARY BATTERY; G. Walter, of Strasburg, Germany. App. filed Aug. 19, 1897. An instrument for removing detached material from storage batteries, consisting of a box-shaped spatula, with a handle, and with ridges extending crosswise of the box, the rear side of the box being closed and the lower end thereof being in the form of a thin, flat wall.

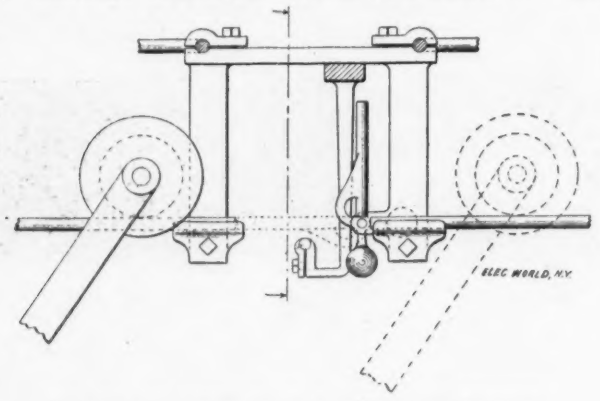
608,031. RAILWAY SIGNAL SYSTEM; G. T. Cunningham, of Boston, Mass. App. filed Nov. 13, 1897. The combination with the track rails divided into sections, of a conductor divided into twice as many sections as there are in each rail, and a connection from the respective conductor sections to the rail sections on opposite sides of the track alternately.

608,076. ELECTRIC TELEPHONE SYSTEM FOR HOUSES; L. Plaut, of New York, N. Y. App. filed Sept. 9, 1897. In an electric house telephone system, the combination with a call box provided with contact plates for the call bell system, and a cover for said call box provided with contact plates for the telephone system, of a spring actuated push spindle, guided in the cover of the box and provided with two contact arms adapted respectively to form contact with the contact plates of the call-bell system in the box and with the plates of the telephone system, on the cover.

608,088. INSULATED RAIL JOINT; G. A. Weber, of New York, N. Y. App. filed Nov. 5, 1897. An insulated rail joint, comprising a rail chair for supporting the contiguous ends of rail sections, having a bolt supporting plate at one edge thereof, insulating material between the ends and said plate, said insulation extending to or near the top of the bolt supporting plate and conforming to the angle of the rail chair, insulated blocks on each side of the rail sections, a bolt or bolts extending through the insulating blocks, rail, insulation and bolt supporting plate, and an insulation for the end of the bolt passing through the bolt supporting plate.

608,100. ANNUNCIATOR GAS FIXTURE; J. L. Bixby, of Arlington, Mass. App. filed Nov. 26, 1897. A cock having a passage connecting its inlet and outlet; a valve controlling that passage a spring plunger controlling that valve, and a cam to move the plunger and automatically hold the plunger when in its elevated position, against the force of the spring.

608,104. ELECTRIC SOUNDING DEVICE FOR SHIPS; J. P. Brockley,



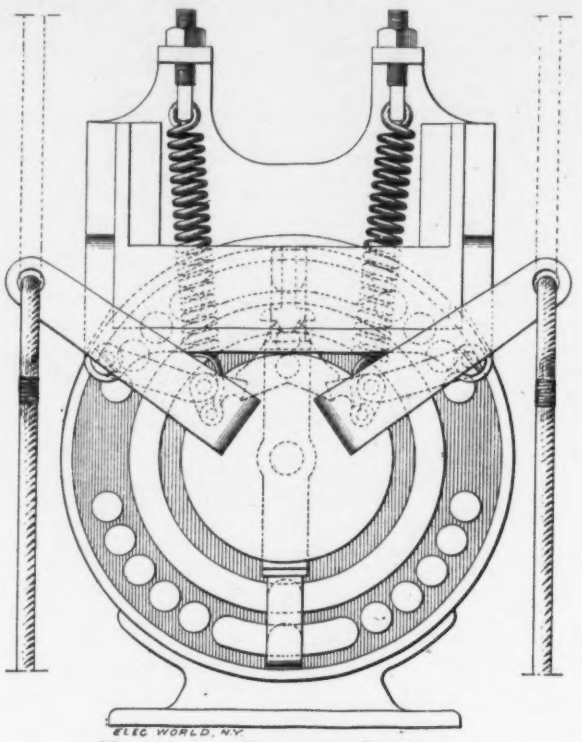
No. 607,918.—Crossover for Trolley Systems.

New Orleans, La. App. filed Dec. 11, 1897. The combination with the sounder adapted to be projected in advance of a ship, and an alarm device on the ship, of the electric wires connecting the sounder with the alarm device, and a float adjustable on said wires.

608,109. ELECTRIC LIGHT FOR SURGICAL PURPOSES; W. E. Dow, of Braintree, Mass. App. filed March 26, 1897. A reflector, having a central hollow shank extending centrally rearward from its centre, and a lens at its front end, an electric lamp and carrier rod therefor, movable within said shank, and means to clamp them in adjust ment.

608,132. ELECTROSTATIC MEASURING INSTRUMENT; J. F. Kelley, of Pittsfield, Mass. App. filed April 14, 1898. In an electrostatic meter, having fixed and movable vanes, a vane electrically connected to a conductor carrying electrical energy, and imbedded in a dielectric to prevent creeping of the charge.

608,133. MEANS FOR PREVENTING STRAY MAGNETISM IN DYNAMO ELECTRIC MACHINES; J. F. Kelley, of Pittsfield, Mass. App. filed May 27, 1898. A dynamo electric machine, having an energizing coil and a magnetic part within the influence of said coil, in which said coil sets up a magnetomotive force, in combination with a coil surrounding said part and adapted to produce therein a magnetomotive force, which neutralizes and prevents the passage through said part of the magnetic flux produced by said first force.

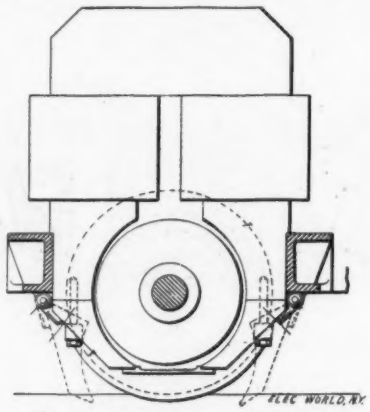


No. 608,013.—Reversing Rheostat.

608,134. ELECTRICAL CIRCUIT CONTROLLER; R. Lundell, of New York, N. Y. App. filed Feb. 1, 1898. A circuit breaker, consisting of electromagnetic means for interrupting an electric circuit, in combination with means controlled by the movable part of the circuit breaker, and adapted to force or eject a blast of air around the circuit breaking contacts thereof.

608,135. COMMUTATOR BRUSH HOLDER FOR DYNAMO ELECTRIC MACHINES; R. Lundell, of New York, N. Y. App. filed Feb. 4, 1898. A brush holder having adjacent brushes rigidly clamped against conducting pieces or blocks, which permit them to abut against each other, said conducting blocks in turn being securely fastened to an arm or stud by means of flexible springs.

608,137. ELECTROMOTQR FOR ELECTRICALLY PROPELLED VEHICLES; A. Siemens, of London, Eng. App. filed Nov. 18, 1897. In an electromotor for propelling a vehicle, the combination with the axle having



No. 608,137.— Electromotor for Electrically Propelled Vehicles.

an armature secured thereon, and rotating therewith, of field magnets located above said armature, pole pieces depending from said field magnets and partly surrounding the armature and extending in a plane at right angles thereto, said pole pieces being formed in two parts having a hinged connection, whereby the lower portions thereof may be swung back to permit the body of the vehicle, with the magnets, to be raised off of the armature, and means for securing the two parts of the pole pieces, in fixed relation to each other.

608,163. BICYCLE LOCK; F. V. Walstrom and John Erickson, of Chicago, Ill. App. filed May 13, 1897. In a bicycle lock, the combination of a locking mechanism, an alarm separate from said lock, but electrically connected therewith, a contact device at the lock adapted to be operated by the bicycle upon its insertion or removal to open or close the alarm circuit, and a second contact device in said circuit.